BLUE JAY

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Fron *on p. 98.*
Harold Fisher

Back cover: *Figure 3. Eastern yellow-bellied racer captured near Castle Butte in the Big Muddy Badlands, SK, in May of 2010, thereby extending the known range of the species in the Big Muddy Valley to the north-west. This live eastern yellow-bellied racer is the first one reported in the Big Muddy Valley since 1976. See article by Gardiner* et al. *on p. 70.* *Chris Somers*

Figure 1. Postcard of the whooping crane diorama by R.D. Symons based on Neil Gilmour's photographs and description of their nesting habitat at Shallow Lake, in the Saskatchewan Museum of Natural History. This exhibit was destroyed in a fire in 1990. (Reproduced with permission from the Royal Saskatchewan Museum.) See article by J.K. Finley on p. 88.

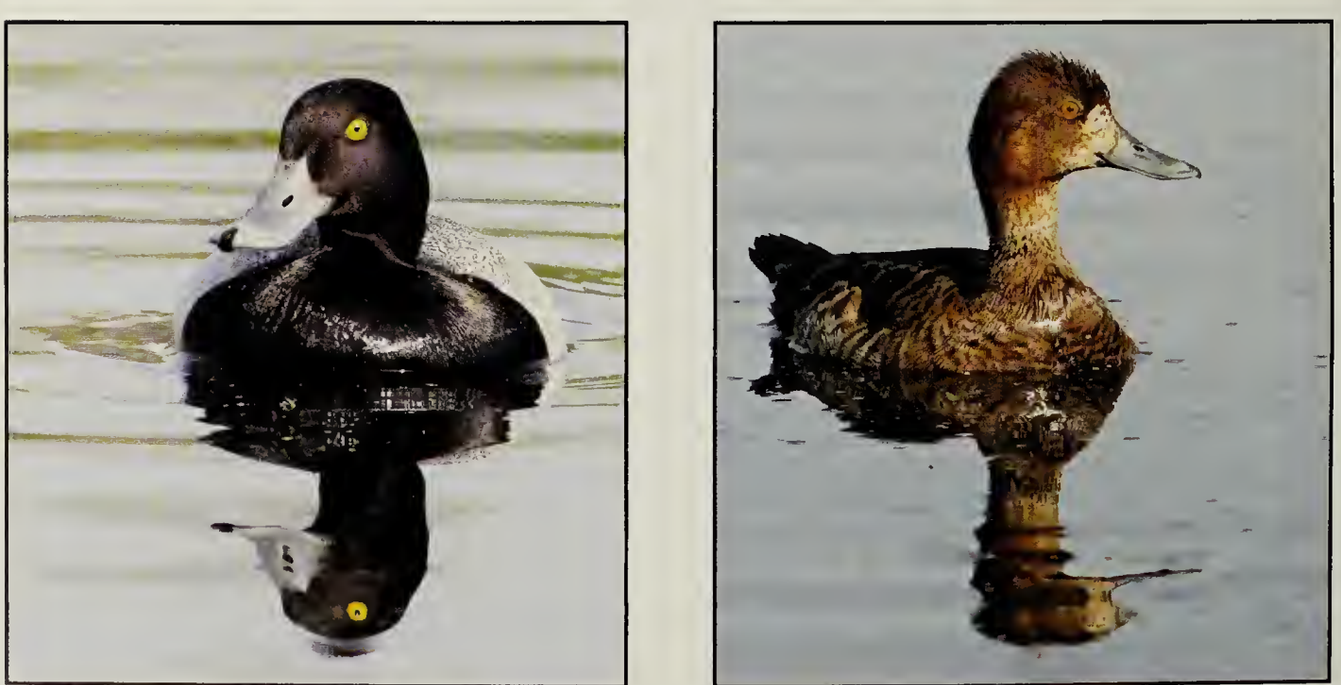

Figure 1. Lesser scaup male (left) and female (right) in breeding plumage. See article by G. Hammell on p. 54. *Nick Saunders*

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BIRDS

LESSER SCAUP AND RACCOONS: ARE THERE LINKS IN SOUTHWESTERN MANITOBA?

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ABSTRACT

Raccoons (*Procyon lotor*) invaded the southern prairie provinces of Canada during the mid-1990s and became a significant predator of waterfowl nests. Nest predation by this novel predator may alter the reproductive success, and thereby the population size of waterfowl like the lesser scaup (*Aythya affinis*). However, it is difficult to evaluate the effects of raccoon predation relative to other factors that affect scaup populations. To investigate possible links between raccoons and lesser scaup, a species with declining populations, I examined results from studies conducted in southwestern Manitoba before (1950's) and after (1970's) the arrival of the raccoon. Specifically, I attempted to detect possible changes in scaup breeding population size, reproductive success, and hatching chronology that might be related to the arrival of raccoons. I hypothesized that the post-raccoon period would show: (a) decreasing local scaup breeding populations due to lower recruitment as a result of decreased nest success and female survival and (b) a shift in the mean hatching date to later in the season because of increased nest losses and more renesting attempts by female scaup. Local breeding populations appeared unchanged before and after raccoon arrival, providing no strong evidence of an impact on numbers of adult birds. The extent of change to reproductive success was uncertain given available data. However, there was a detectable shift in hatching chronology to later dates in years with wetter summers. It is possible that the shift in hatching chronology could be related to raccoon predation of scaup nests and changes in renesting rates among time periods, but it is impossible to say for sure given the available data. Nevertheless, such a shift may have been detrimental to local populations over the years, as later-hatched ducklings have a lower probability of recruitment into the breeding population.

INTRODUCTION

Lesser scaup (*Aythya affinis*) are medium-sized diving ducks that breed in the boreal forests and parklands from Alaska to Manitoba.[1] In breeding plumage, males are black and white and females are dark chocolate brown with a white face patch (Fig. 1, see inside front cover, bottom). Combined North American breeding populations of lesser scaup and similar-looking greater scaup (*A. marila*) have been declining from highs in the 1970s of 5–7 million birds to lows of 3–4 million in the 2000s (Fig. 2).[2] Lesser scaup comprise ~90% of the combined population;[1] most of the decline has been attributed to this species, especially within the Canadian western boreal forest, where most of these birds breed.[3] Lesser scaup (but not greater scaup) breed in south-western Manitoba parkland, and

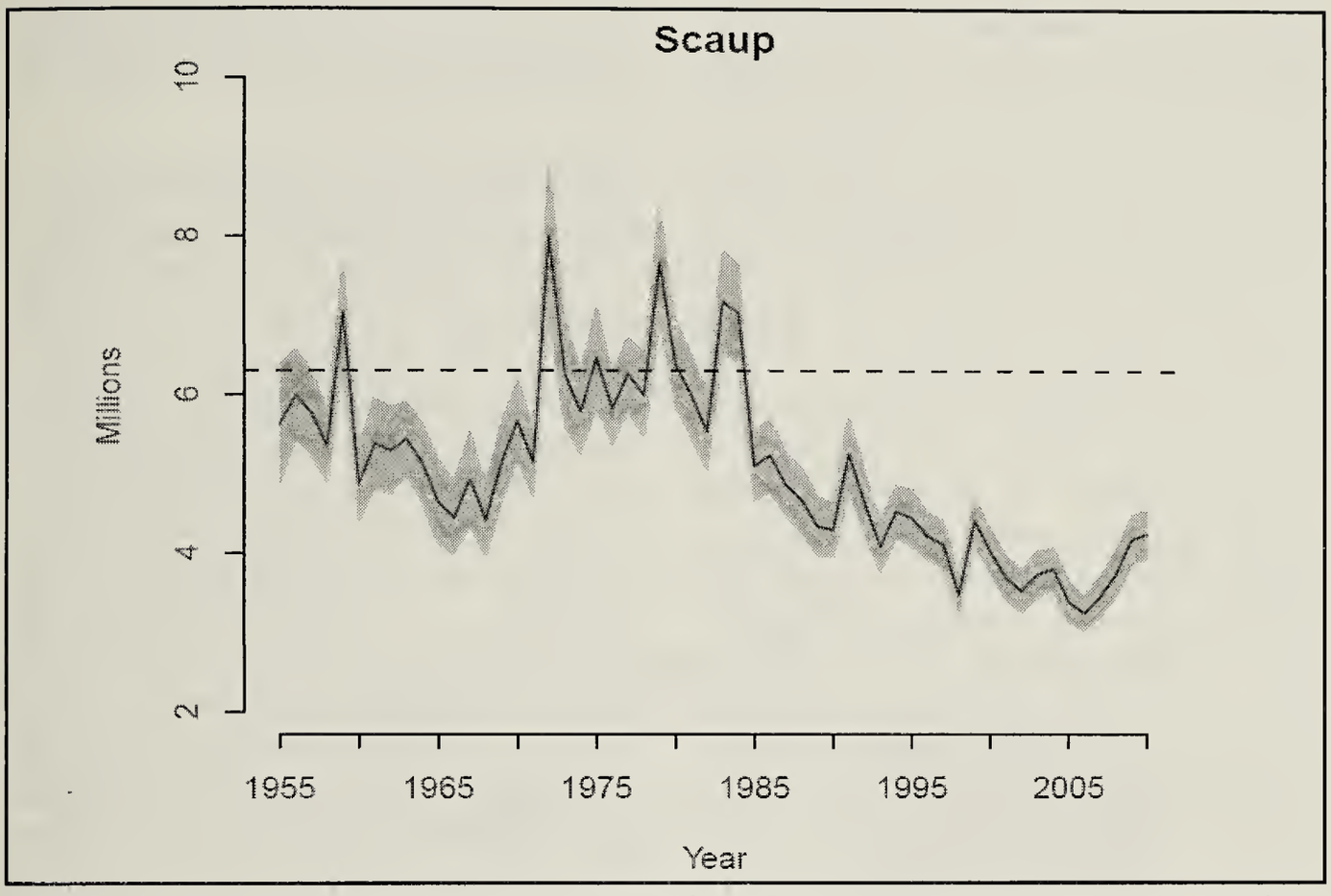

Figure 2. Breeding population estimates, 95% confidence intervals, and North American Waterfowl Plan goal (dashed line) for scaup (lesser and greater) in the traditional survey area (strata 1–18, 20–50, 75–77).

long-term but less consistent declines in breeding pairs have also been noted there.[3,4] Several hypotheses have been presented to explain declining lesser scaup (hereafter scaup) populations, including changes to food resources in wintering and migration habitats,[5-7] chemical contaminant exposure,[1,8-11] climate changes affecting boreal forest wetlands,[3] lower female survival,[3,12] and fewer immature birds relative to adults in human harvests (declining age ratio).[3] However, no clear explanation for the decline has been determined. Declining age ratios in the harvest are suggestive of reduced recruitment, and contributing factors could be any combination of reduced breeding propensity, reduced clutch size and renesting rates among hens, or decreased nest and/or juvenile survival.[3] Reduced nest, juvenile, and female survival have been suggested as proximate causes of decline in local scaup populations in south-western Manitoba and in the boreal forest of the Northwest Territories.[4,13] The major factor responsible for waterfowl nest failure and female and duckling mortality on the breeding grounds is predation,[1,14-16] so predation may be an important factor (but not necessarily the only factor) in explaining reduced recruitment. Therefore, changes to the local predator community (size or composition) might contribute to changes at the local scaup population level.[17,18]

The parkland area of southern Manitoba experienced a change to the predator community with the invasion of the raccoon (*Procyon lotor*) during the mid 1900s.[19] Raccoons have the potential to be a significant predator of scaup nests, but not females,[20] because they search for prey in the upland and emergent vegetation zones adjacent to ponds,[21,22] where most scaup nests are found.[23-27] Previous studies have reported that raccoons are indeed a major predator of scaup nests in south-western Manitoba.[23,28] In this area, more

than 50% of scaup nest over water (nest surrounded by water), and more of these nests are successful than are dry-land nests.[23,27] Over-water nests, which may be isolated from dry-land predators for some or all of the incubation period, presumably would be more vulnerable to raccoons because of their nest-searching behaviour. Thus, the arrival of raccoons may have resulted in increased nest losses, reduced productivity and reduced juvenile recruitment. Also, if initial nests are destroyed, some scaup do attempt second nests (renests) depending on female age and habitat conditions.[28] This increased nesting effort resulting from increased initial nest destruction can lead to greater nest-site exposure to predators (e.g., fox [*Vulpes vulpes*] and mink [*Mustela vison*]) and increased female mortality.[14,,29] Scaup exhibit natal philopatry and breeding-site fidelity,[1,28] so reduced juvenile recruitment and increased female nest-site mortality might result in a smaller local breeding population. Long-term studies of a different species, the canvasback (*A. valisineria*), in southern Manitoba have shown that with increasing raccoon numbers, nest losses increased and productivity decreased.[30] The extent of canvasback renesting was thought to be closely related to predation. Consequently, for scaup I hypothesized that the arrival of raccoons as a novel predator in southern Manitoba affected scaup populations at the local level. Based on this hypothesis, I predicted: (a) a decrease in the size of the breeding population over time due to lower juvenile recruitment as a result of decreased nest success and female survival, and (b) a shift in mean hatching date to later in the season because of increased nest losses and more renesting attempts by female scaup. Importantly, these predictions are not unique to the novel predator hypothesis and could apply to any number of alternatives based on other factors affecting reproduction. However, there is still some merit in testing my predictions to determine whether any of them are substantiated.

The Consensus Report of the Second Scaup Workshop indicated several priority research topics, one of which was the establishment of retrospective analyses to examine patterns over time and space.[31] Analyses of existing data were considered the most immediate research need because results are critical for forming hypotheses, organizing research projects, and securing funding. With this priority in mind, and to evaluate the novel predator hypothesis, I conducted a retrospective analysis of existing scaup breeding pairs, productivity (broods per pair or nest success) and hatching chronology data from studies conducted in south-western Manitoba prior to the 1980s, which was prior to the decline of the continental scaup population. I focused primarily on the area of Erickson, Manitoba (50° 30' N, 99° 55' W). My main objective was to determine whether changes in reproductive parameters occurred after the arrival of the raccoon. Erickson is well-suited to this analysis because several historical studies cover appropriate time periods (Rogers study: 1957–1960;[24,32,33,] Hammell study: 1970–1972,[23] [and unpublished data]; and Afton study: 1977–80[28]). All three studies were conducted at the same locale, and the raccoon arrival time is known and occurred outside of a drought period, eliminating the severe confounding factor of drought on scaup populations and reproduction.[24] In addition, aerial photos and discussions with the local community suggested that agricultural impact (amount of cultivated, hayed, or pastured land) in the study area was similar across the different time periods, thereby controlling for major habitat change as a factor affecting the results. During the 10-year interval between the earlier studies (1960–1970), raccoons

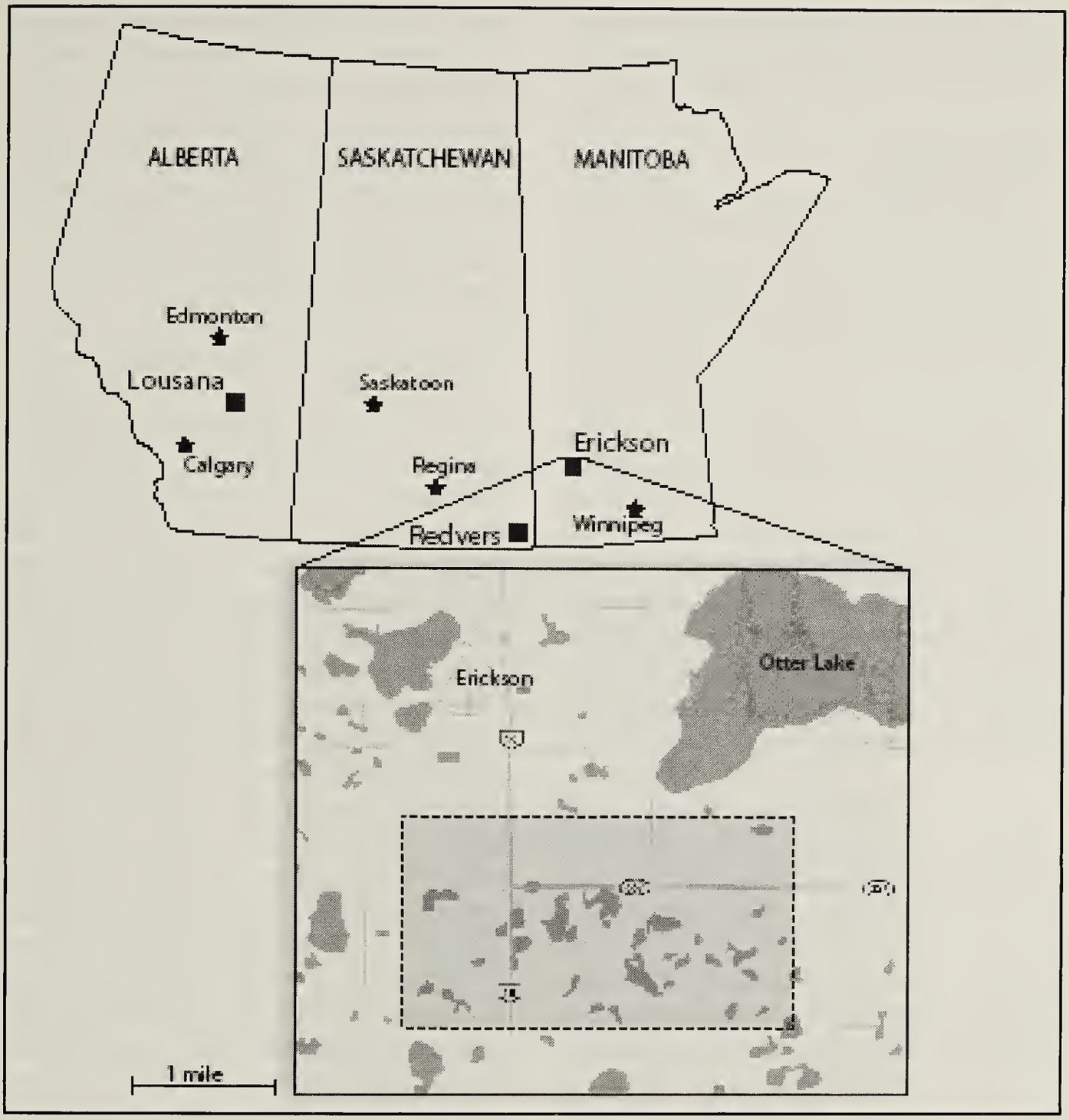

Figure 3. Field study sites (denoted by the small black squares). Shaded area within expanded map represents intensively studied area near Erickson, MB.

were noticed for the first time (mid-1960s) by local residents in the Erickson area. There was no evidence found that raccoons were a predator of scaup during the 1957–60 study (J.P. Rogers, pers. comm.). However, they were a major predator at Erickson by the early 1970s.[23]

METHODS

Study Area

The study area for all three time periods is situated in the parkland pothole region of south-western Manitoba (Fig. 3) and comprises 259 ha for the 1957–60 study, 680 ha for the 1970–72 study, and 777 ha for the 1977–80 study. The two former areas are situated entirely or mostly within the larger area. These block areas were most intensively studied, but additional data were collected from larger lakes and along roadside transects in the Erickson area of approximately 80 km (1957–60) and 71 km (1970–72). The topography is rolling with numerous ponds and lakes. The uplands are a mixture of lands sown

to cereal and oilseed crops, hay, pasture, and native woodland. The area is well described in previous studies.[24, 27,28,34]

Field Methods

Scaup were counted weekly by investigators walking on the entire Rogers and Hammell block study areas. Estimates of the breeding lesser scaup population were derived from the average of the two or three counts of pairs seen during the pre-laying period (late May to mid-June). In all studies, scaup nests were located by observing females flying to nests and by conducting systematic foot searches around the margins of all ponds on the study area from early June to early August. Information collected at each site included vegetation characteristics, distances to water and dry land edge, number of eggs, estimated initiation date, and nest success.

Broods of scaup are relatively easily located on rearing ponds, usually swimming to open areas in the pond centre when disturbed.[23,28] For the Rogers and Hammell studies, broods were observed in the main study block and additional numbers were recorded on area lakes and along the roadside transects. Both authors estimated brood ages by juvenile plumage characteristics.[23,24,35,36] Hatching dates were determined by backdating from the brood observation date. For each brood, age class was estimated and a day-of-year hatch date (usually the mid-point of the age class) was assigned for the Hammell data. Rogers[24] conducted weekly surveys on his block area, and additional ones on local lakes and on the roadside just prior to the expected fledging date of the earliest hatched ducklings. Hammell conducted surveys every 3 to 4 days on the block area and weekly on the roadside transect throughout the entire brood period from late July to late September.[23] Afton provided no hatching chronology data.[28] Care was taken by investigators to use duckling number and age to ensure that sightings of individual broods were not duplicated. It was not possible to distinguish which broods were from initial nests and which were from re-nests for the earlier (unmarked bird) studies, but I assumed that later hatching broods were from renesting attempts.[25]

Local Populations and Nest Success

To compare changes in population densities for different sized study areas, I re-examined raw data (1970–72) for the Hammell study (data not available for the Afton study) and determined the number of scaup pairs on the same square mile (259 ha) used by Rogers. This resulted in total pair counts for 1970–72 on the 259-ha block area that were >75% of those numbers recorded on the larger 680-ha area. I also examined raw data from United States Fish and Wildlife Service (USFWS) annual waterfowl surveys for the Erickson area,[37] did regression analysis for the period 1955–80, and compared the results to those from the ground studies. Existing long-term population and productivity data from other authors were available for south-western Manitoba[38] and other Prairie-Parkland Region studies,[39,40] and were compared to Erickson data. To evaluate nest success at Erickson for the periods before and after the raccoon arrival, I examined and compared broods/pair data for the Rogers and Hammell studies and nest success data from Afton's marked bird study. I chose data for author-described non-drought years only (1957 and 1970–72, 1978–80) in an attempt to reduce drought-induced nest success biases,[24] which would most likely mask any raccoon effects. Again, additional support for this decision is provided by the long-term research conducted on canvasbacks in south-western Manitoba.[30] Here, the effect of the raccoon was most noticeable in wet

years, and I assumed that a similar pattern might apply to scaup, as most scaup at Erickson nest over-water. Nonetheless, one might expect some raccoon effect in drought years; however, during drought periods, water levels recede drastically and usually all nests become exposed to predators (including those predators normally associated with dry uplands), potentially negating the specific effects of raccoons.

Hatching Chronology

Hammell estimated brood age by juvenile plumage characteristics developed for scaup.[36] Although Rogers aged scaup broods using criteria developed for juvenile redheads (*Athya americana*),[35] he applied an adjustment (6 days for each of the eight age classes) to allow for the fact that scaup reach the flight stage sooner than redheads (J.P. Rogers, pers. comm.). Calculations of possible results obtained using both methods for each age class revealed that different ages could be attributed to a given age class but that these differences were small, averaging less than 2 days (range: +1 to –4, Hammell age minus Rogers age) and depended on brood age at observation. Brood age at observation time is unknown for the Rogers data so the extent and direction of any bias is unclear. I assumed that this bias would not be significant. Consequently, I did not apply any corrections to Rogers' hatching date data and made the assumption that the aging criteria used in the two time periods were similar and the data were comparable. Mean hatch date was not provided for the earlier Erickson data, so in order to make meaningful comparisons, day-of-year of 65% brood hatch (65%HD) was selected as a date for reference.

To conservatively account for possible year effects at Erickson (late versus early, wet versus dry) on first clutch initiation dates (CIDs) and hence the observed 65%HD, I considered author descriptions of spring and summer water conditions, dates of first laying attempts, and meteorological data[41] from Brandon, MB, 63 km south (for 1957–60) and Minnedosa, MB, 25 km south (for 1970–72). Weather data for Minnedosa are incomplete for the years 1957–60. Again, I looked for years with similar climatic conditions and avoided drought years in the analysis because their datasets are very small and drought seriously affects scaup reproduction at Erickson.[24] In addition, to further account for possible differing clutch initiation chronologies, I subtracted from the observed difference in 65%HD the maximum difference (6 days) in mean CIDs for first nests between years recorded for the same area from 1977 to 1980.[28] Recorded CID means could not be compared for the two earlier studies, since these data contained unknown degrees of renesting influence.

RESULTS

Breeding Population, Nest Success, and Productivity

Erickson

Initial analysis produced equivocal results for Erickson population trends for the period before and after raccoon arrival. Scaup breeding populations were lower after the raccoon arrived, but this decrease appears to be drought related and occurred between 1958 and 1959, before the time of arrival (Table 1). Admittedly, the available data are limited and lacking for the years 1961–69, but they do suggest a similar population level of ~7 pairs/km^2 immediately before (1960) and after (1970–72) the raccoon arrival, which occurred in the mid-1960s. This result does not support the expectation of an observed breeding population decrease after raccoon arrival. However, total scaup counted on USFWS annual waterfowl and habitat surveys[37] near Erickson (1955–80; stratum 40: transect 4, segment 4; transect 6, segments 3

and 4) showed a downward trend from 1955 to 1980 (Fig. 4, simple linear regression, $r^2 = 0.199$, 24 df, $p = 0.02$). These data contained very high counts from 1958–62 (the drought years in the Prairie-Parkland Region),[42] and it is suspected that birds from dried-out areas of the prairies immigrated to the relatively wetter parkland areas during this period, especially areas like Erickson with large permanent lakes (some of which are covered by the USFWS survey segments) and that this influx bolstered numbers on the survey segments. This movement of waterfowl to wetter areas in time of drought is well documented,[43-45] and a previous study recorded a similar increase in scaup numbers at Minnedosa during the same drought period.[42] By excluding the drought years from the USFWS data for Erickson, no significant trend in population numbers occurred for the period encompassing the years before and after the raccoon arrival (Fig. 5, $r^2 = 0.003$, 19 df, $p = 0.8$); thus, results from both sources for Erickson local population data concur. Therefore, the expectation that the Erickson population would decline after the raccoon arrival is not supported by the available data.

Erickson scaup reproductive success (nest success and productivity) data show that great variability occurred in years before and also in years after the arrival of the raccoon (Table 1). Reproductive success, evaluated for non-drought years (see METHODS), was high and similar in 1957 and 1971 and lower in 1970,'72,'78,'79, and '80; that is, lower

Table 1. Estimated breeding population (pairs/km^2)[a] and production (broods/pair or percent nest success) of lesser scaup at Erickson, MB, 1957–1960, 1970–72, and 1977–80 (see text for data sources). Numbers in parentheses are sample sizes. Raccoons arrived during the mid-1960s.

Year	Population	Production
1957	21	0.50 (27/54)
1958	25	0.05 (3/65)
1959	9	0.08 (2/24)[b]
1960	7	0.18 (3/17)[b]
1970	7	0.23 (5/22)
1971	6	0.58 (11/19)
1972	7	0.13 (3/23)
1977	n/a	18% (17)[c]
1978	n/a	29% (24)[c]
1979	n/a	40% (47)[c]
1980	n/a	27% (41)[c]

[a]On Rogers' block study area (2.6 km^2)[24]
[b]Calculated from the number of ducklings/average brood size
[c]Number of marked birds in sample

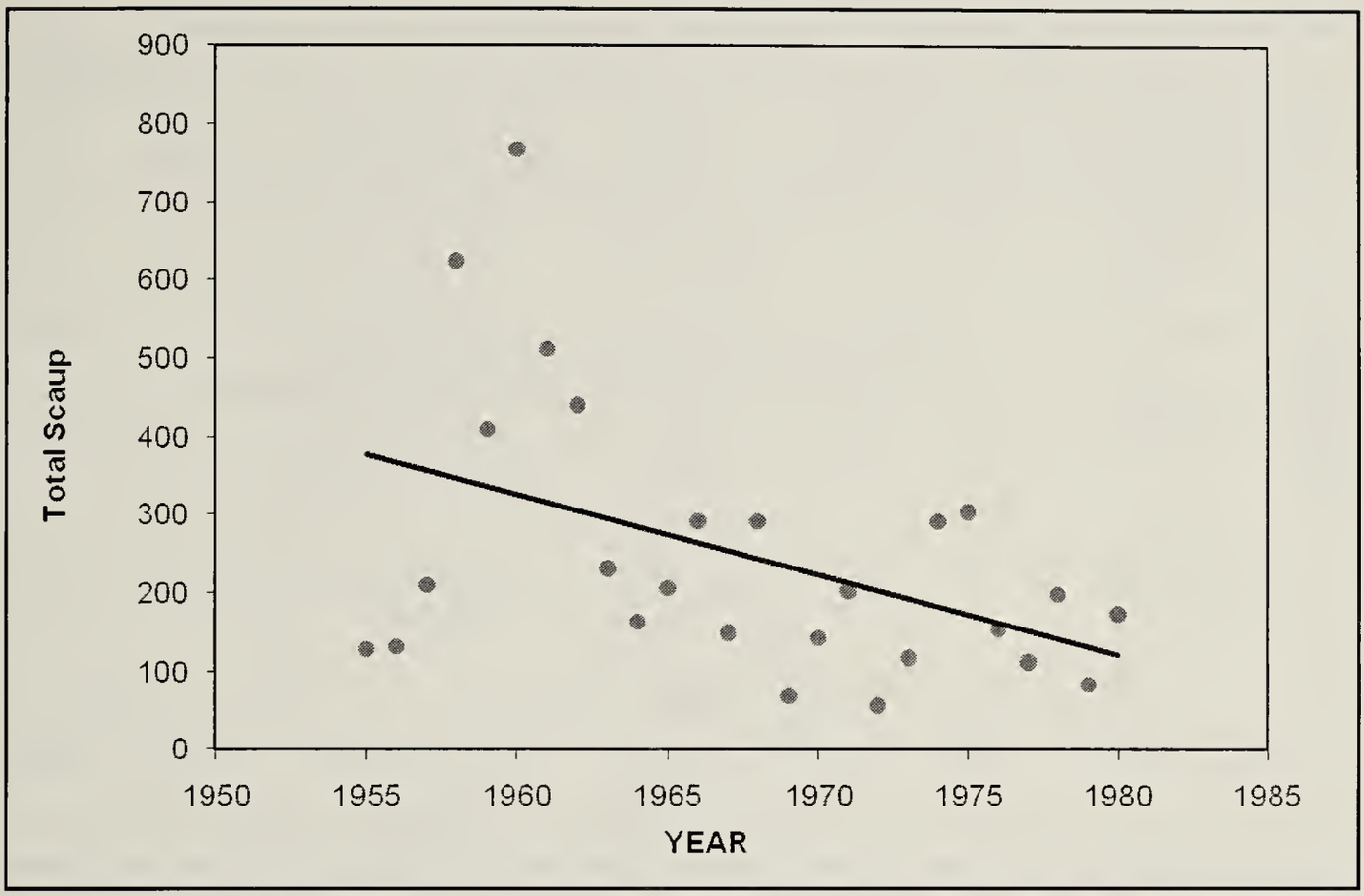

Figure 4. Total scaup (lesser and greater) counted on USFWS annual waterfowl surveys near Erickson, MB, 1955–1980. Raccoons arrived during the mid-1960s.

in five of these six years after the arrival. Therefore, these results (for most years) support the expectation that reproductive success would decline after the arrival of raccoons.

Other Locales

In addition to the Erickson local data, there is some long-term evidence from transects established in a 10,600 km^2 area of south-western Manitoba[36] (Erickson area included) that supports the view that scaup breeding population densities had not changed after the appearance of the raccoon. Trauger and Stoudt summarized the data available from these transects and found that scaup pair densities showed no change from the late 1940s to the late 1970s, despite habitat changes and the arrival of the raccoon in the period ~1955–65.[42] Nest success and productivity data for scaup were not provided. In contrast, in other parkland habitats (Fig. 3) at Redvers, Saskatchewan (49° 34' N, 101° 42' W),[39] and Lousana, Alberta (52° 06' N, 113° 11' W),[40] scaup populations and nest success did decrease after the arrival of the raccoon. This arrival occurred in the late 1950's to early 1960's, a little earlier than at Erickson; however, as in south-western Manitoba, raccoon densities were not recorded at these locales, so it is not possible to compare their relative abundance. After the drought period and into the late 1970's,[42] scaup breeding populations remained lower (50% lower at Redvers, 33% at Lousana), and productivity (broods/pair) was lower at Redvers but showed recovery at Lousana.[39,40]

Hatching Chronology

When comparing April/May pond conditions, 1957 and 1970–72 were wet and similar, and when comparing May to July water regimes, 1970 and 1971 were similar, and 1972 less so to 1957 (Table 2).The years 1957 and 1970–72 with flooded emergent zones were markedly dissimilar to the years 1958–60, which had drier spring conditions. Mean maximum

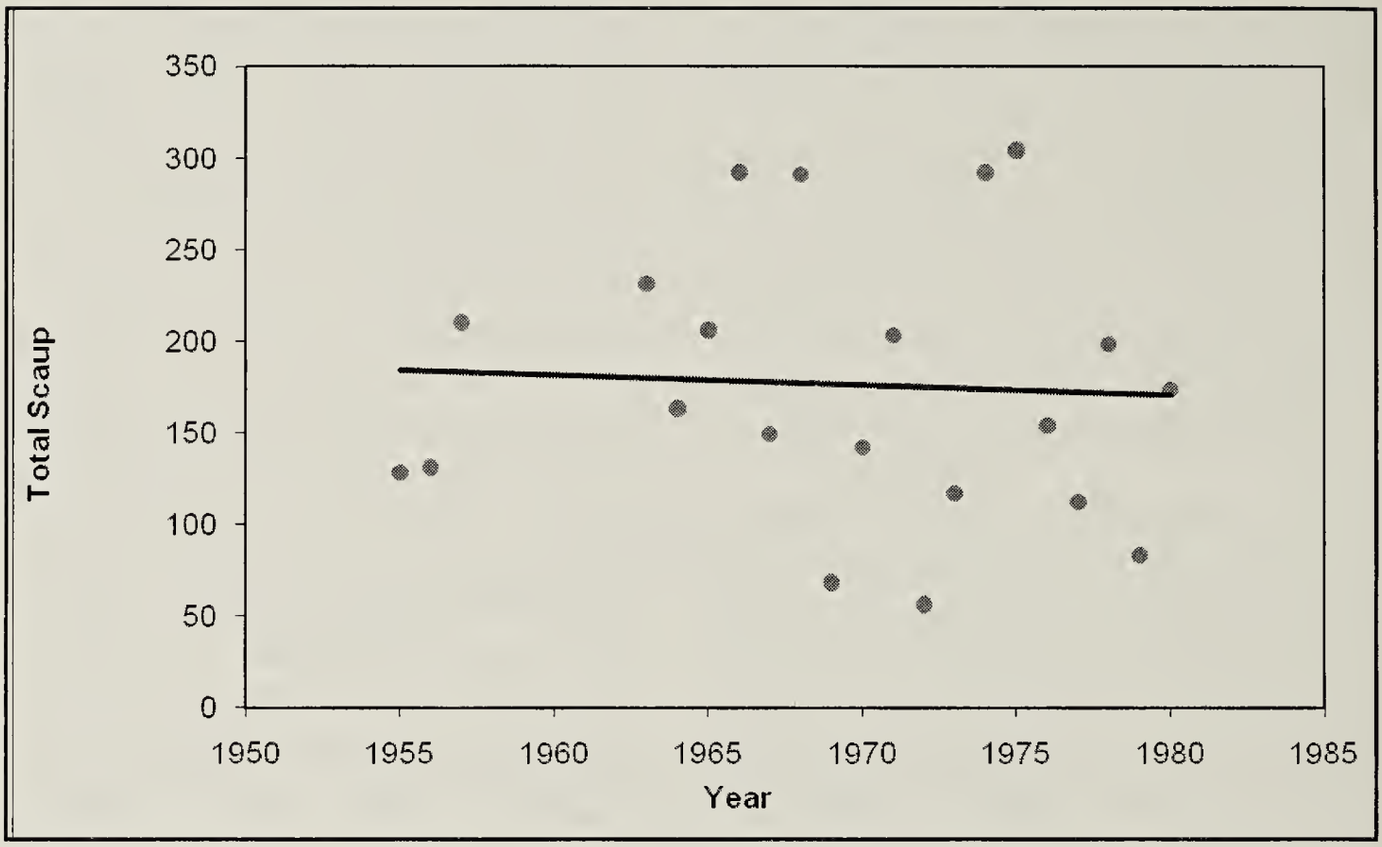

Figure 5. Total scaup (lesser and greater) counted on USFWS annual waterfowl surveys near Erickson, MB, 1955–1957 and 1963–1980 (drought years have been excluded). Raccoons arrived during the mid-1960s.

temperatures for April and May support the observations of the authors that spring 1970 was cooler and later than the other years and that springs 1971, 1972, and 1957 had similar temperature conditions (Table 2). Based on these available data on water regimes and nesting habitat quantity and quality for the years 1957–60 and 1970–72, I restricted my hatching chronology comparison of the two time periods to 1957 and 1970–72 (See METHODS). All of these years presented very good habitat conditions in the spring. Also, all first CIDs are close despite years having early and late springs, except for 1959, the very dry year. These dates support the assumption that at Erickson, all years (except 1959) had similar CIDs. In fact, recent research suggests that scaup are quite inflexible in timing of clutch initiation, resulting in low annual and site variation for this parameter.[46]

Hatching chronology shifted to later dates than those in 1957 in years with severe predation (1958, 1959, 1960) and in all years after the raccoon arrived (Tables 3 & 4). The estimated 65%HDs for 1970–72 (after raccoon arrival) are from 1 to almost 3 weeks later than those for 1957; i.e.,16, 18, and 7 days later, respectively (Table 4). Adjusted estimated hatching date differences (to account for possible year effects: see METHODS) are 10, 12, and 1 day(s). These results for 1970, 1971, and, to a much lesser extent, 1972 support the hypothesis that a shift in hatching chronology would be expected after the arrival of the raccoon at Erickson.

DISCUSSION

Breeding Population, Nest success, and Productivity

The prediction that breeding populations of scaup would decrease after the arrival of the raccoon was not supported by the data available for south-western Manitoba. Interestingly, these results for scaup are similar to those observed for canvasbacks near Erickson, where breeding pair densities of this over-water nester also did not differ after

Table 2. Habitat and meteorological conditions at Erickson, MB, 1957–60[a] and 1970–72[b].

Year	Spring Conditions	Spring to Summer Pond Water Levels	Emergent Zone[c]	April/May Mean Max.	Temp. C°	First Observed Nest Initiation Date[d]
1957	very wet	high and stable	all flooded to mid-July	8.4	19.2	10 June (10)
1958	dry	moderate and falling very rapidly	sedge zone dry by June	12.2	M	12 June (18)
1959	very dry	very low and falling very rapidly	mudflats beyond emergent zone	9.8	15.5	19 June (13)
1960	dry	moderate and falling	sedge zone hayed and grazed, dry by June	6.8	18.7	11 June (5)
1970	wet	high and falling slowly	flooded to mid-July	3.5	13.8	14 June (20)
1971	wet	high and rising	flooded to September	8.4	17.3	9 June (30)
1972	wet	high and falling	flooded in spring; sedge meadows dry mid-July	6.3	19.0	12 June (13)

[a]meteorological data from Brandon, MB
[b]meteorological data from Minnedosa, MB; M = data missing
[c]emergent zone comprises cattail *(Typha latifolia)*, bullrush *(Scirpus acutus)* and sedges *(Carex spp.)*
[d]sample size in parentheses

raccoon arrival, although it was believed that observed decreased productivity (broods/pair) could be attributed to the raccoon.[30] It is unclear what effect the presence of the raccoon had on this local scaup breeding population stability. A potentially larger population could have been depressed by pressure from this predator, through lower recruitment resulting from reduced nest success or productivity, to the observed 1970's levels. Alternatively, the raccoon could have been having no or minimal effect, and the resulting population size was due to other factors. Also, as expected, reproductive success data for Erickson suggest a decline in productivity in most years after raccoon arrival. However, the dataset prior to 1970 is limited to one non-drought-affected year, and scaup reproductive success after 1970 is highly variable even between wetter years. Given such scant comparative data, I am unable to say with any certainty that reproductive success did indeed change after the arrival of raccoons. A larger dataset from non-drought years prior to the mid-1960s might provide more clarity and confidence in the interpretation of the results. Such population and reproductive success results allow for few conclusions regarding possible effects of a novel predator at Erickson. However, they do suggest no obvious links between scaup breeding population size and the arrival of raccoons.

Table 3. Estimated time of hatching of lesser scaup broods near Erickson, MB. Data from 1957–60 from Rogers;[24] 1970–72 from Hammell[23] (and unpublished data). Raccoons arrived during the mid-1960s.

Year	July 1-7	July 8-14	July 15-21	July 22-28	July 29-Aug 4	Aug 5-11	Aug 12-18	Aug 19-25	Total
1957	6	27	38	18	7	2	8	3	109
1958	1	0	0	3	1	4	0	0	9
1959	0	0	0	0	0	1	3	0	4
1960	0	0	0	3	2	5	0	0	10
1970	0	1	4	7	15	10	6	0	43
1971	0	1	5	13	5	15	13	1	53
1972	1	2	7	8	1	3	0	0	22

In contrast, at other parkland areas (Redvers and Lousana) for a similar time frame, populations and nest success did decline and productivity was variable after raccoon arrival. Again, it is unclear what effect raccoons were having at these locales, since their arrival was coincident with severe drought and deteriorated habitat, but the authors concluded that the only condition affecting wide fluctuations in waterfowl breeding populations was drought and the size of the continental population, not variations in local production. More subtle effects (raccoon) were beyond the scope of their investigations. It is not known whether the novel predator hypothesis as proposed for Erickson scaup would be applicable to these other areas, and since any hypothesis applying to a wider spatial effect would need more data for evaluation than was available to me, further examination has not been attempted here. In summary, I am only able to say with certainty that between the late 1950's and the late 1970's and coincident with the arrival of raccoons, breeding populations of scaup appeared to remain stable in south-western Manitoba, contrary to expectations, but declined in south-eastern Saskatchewan (Redvers) and in south-central Alberta (Lousana).

Hatching Chronology

I restricted my hatching chronology comparison of the two time periods to 1957 and 1970–72 to control for year effects (see METHODS). Since the dataset is limited in years not suffering from drought before the arrival of the raccoon at Erickson (1957 only), there is the possibility that this year was an anomaly. I cannot substantiate the assumption that it was not. Also, there is a possibility of a bias in comparing observed chronologies resulting from different methods of aging broods (see METHODS). Given that this bias appears to be small and could increase or decrease observed differences in hatching chronologies depending on brood age at observation time, I assumed that both sets of data were comparable. Accordingly, caution is advised when considering the interpretations discussed here.

Despite applying additional year effect adjustments (total = –6 days) to the Erickson data, a shift in hatching

Table 4. Scaup hatching chronology data for the period before (1957–60) and after (1970–72) the arrival of raccoons[a] in Erickson, MB.

Year	% of broods hatched by day 202 (July 21)	Day of 65% brood hatch	
		Actual	Difference from 1957 value (days)
1957	65 (109)[b]	202	~
1958	11 (9)	>217-<223	n/a
1959	0 (4)	>224-<230	"
1960	0 (10)	>217-<223	"
1970	12 (43)	218	16 (10)[c]
1971	11 (53)	220	18 (12)
1972	45 (22)	209	7 (1)

[a]racoons arrived during mid-1960's
[b]no. of broods in sample
[c]adjusted difference from 1957 value

chronology of 10 and 12 days later than that observed in 1957 occurred for the two years (1970, 1971) with water regimes closest to those of 1957 (Table 4). In contrast, the adjusted estimate for 1972 indicates little change from 1957 despite heavy depredation losses in 1972. This result may have been caused by very little renesting effort and/or success of renests due to rapidly falling water levels during the summer (Hammell, unpubl. data). Over-water nests were isolated on drier ground and exposed to the full complement of predators, including those dryland predators not usually associated with over-water nest predation (pers. obs.) Very few broods hatched after 28 July 1972 compared to the two other years (Table 3), and therefore 65%HD occurred earlier.

The full clutch initiation adjustment could apply to 1970 as it was a late year (Table 2) and the first nesting attempt was later. A smaller clutch initiation adjustment (<6 days) may be more appropriate for 1971 and 1972 since these years appear to have had very similar spring temperatures to those of 1957. This reduced adjustment would produce a shift in hatching chronology to later dates for 1971 (>12 days) and for 1972 (>1 day). The years 1958–60 were drought-affected years and suffer from small datasets but do show delayed hatching chronology even without the raccoon being present. These results were thought to be due to gonadal inhibition of nesting effort and/or deteriorated spring nesting habitat leading to delayed CID and/or very low early-season nest success.[24] These Rogers study data suggest that a shift in scaup hatching chronology to later dates can also be expected in years with drought-induced deteriorated habitat.

The 1970–72 Erickson data suggest that a similar shift occurred in non-drought years as well, years when water levels were stable and adequate. This shift coincides with the arrival of the raccoon, a significant predator of scaup nests, and according to my hypothesis, one might expect such a shift to a later period after the arrival of the raccoon. The available data provide one explanation

of the possible relationship between this predator and scaup hatching chronology. Prior to the appearance of the raccoon, over-water nests (representing ~60% of nests[4,23]) may have had an advantage through isolation from dryland, as most predation of scaup nests at that time was attributed to skunk (*Mephitis mephitis*;[24] J.P. Rogers, pers. comm.), a predator usually associated with dryland habitats.[20] In years with wet summers, over-water nests are more successful than dryland ones even with raccoons present[23,27] and may have been even more so prior to the 1960s. The arrival of a novel predator of over-water nests would be expected to have some new influence on these previously less vulnerable nests, possibly causing increased losses and subsequent increased renesting. These new nests, if successful, would hatch later, resulting in an advanced hatching chronology.

Undoubtedly, other factors responsible for changes in scaup hatching chronology exist and may be many (e.g., female age and breeding condition affecting CID[5-7,28] and factors affecting nest success, including propensity to renest and predator community, their behaviour, and prey[13]) and may co-vary and make difficult any attempt to determine the importance of each. My analysis does not control for the possibility of these other factors influencing the results, although I have tried to control for year effects. A causal relationship between raccoons and hatching chronology could exist at Erickson, but that relationship has not been proven here. I have only provided indirect evidence of a link to raccoons during wet years. Further research into possible predator-related links to changes in hatching chronology involving scaup or other avian species might help determine the extent of this effect.

Water conditions are variable in the parklands of Canada, and years with good production potential for scaup are limited, so it is imperative that any additional downward pressure on that reproductive potential be avoided in years with favourable breeding habitat if populations are to be maintained. Later hatching dates during wet years, as observed at Erickson, could be such a pressure, and later hatching dates for scaup and other *Aythya* species have been associated with reduced size of ducklings and adults, and a lower probability of recruitment to the breeding population.[47,48] Those authors believe that late-hatched juveniles have a smaller probability of recruitment because they may have less time to acquire the resources necessary to mitigate the costs of migration. Females staying with these later broods spend little time feeding[49] and have shorter times to regain body condition in preparation for migration.[50] In addition, egg-laying and incubation are dangerous periods for female scaup (increased exposure to predation), and female annual survival appears to be lower in years when breeding propensity is high; i.e., there is a survival cost in attempting to reproduce.[29] Therefore, if the observed shift in hatching chronology was the result of increased renesting, then by doing so, females may experience increased exposure to predators, possibly resulting in increased female mortality. Furthermore, total juvenile production would be reduced if renests (which generally have fewer eggs per nest than initial nests) comprised a greater proportion of total successful nests. Accordingly, over the years, the later hatching chronology could prove detrimental to the local Erickson population and may have contributed to the regional decline observed today[4] (Hammell, unpublished data).

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Ryan McCulloch took this photo of a fox pup, one of a litter of six, south of Morse, SK, on 6 June 2011. Ryan is only five years old !

REPTILES

EASTERN YELLOW-BELLIED RACER POPULATIONS ON THE CANADIAN PRAIRIES

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Figure 1. Threatened eastern yellow-bellied racer in a creeping juniper patch at the Snake Pit hibernaculum, the largest known snake hibernaculum in Grasslands National Park, SK. *Laura Gardiner*

The eastern yellow-bellied racer (*Coluber constrictor flaviventris*; Fig. 1) has been identified as a Species at Risk in Canada, with previously published observations suggesting that its range was confined to small areas in southern Saskatchewan in the Big Muddy and Frenchman River Valleys.[1] In particular, Grasslands National Park has been the only confirmed location for a population of this snake for some time. The eastern yellow-bellied racer has been assessed

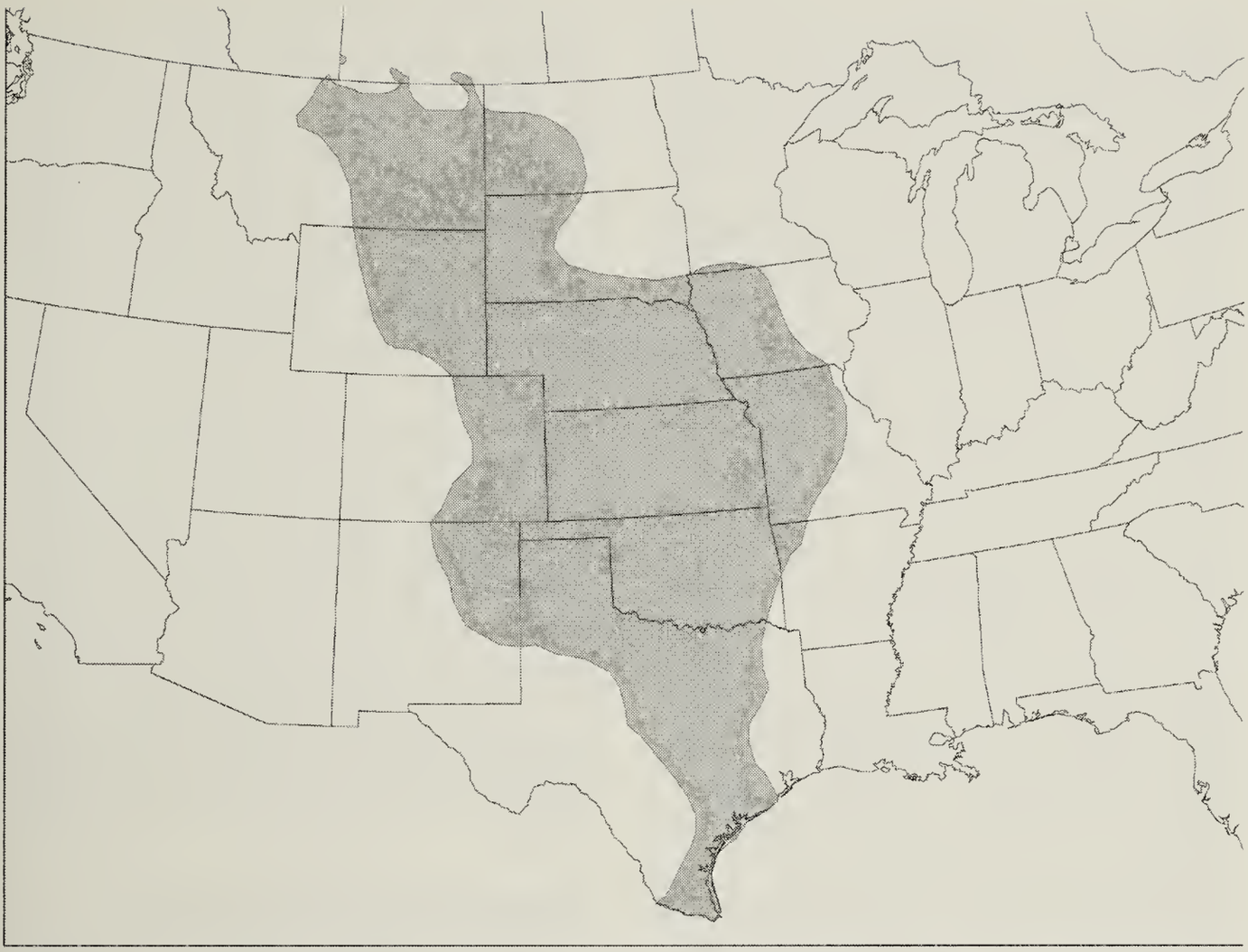

Figure 2. Geographic range of the eastern yellow-bellied racer in North America. Canadian populations are at the northern extreme of the range for this snake species.

as Threatened with extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) because of its small geographic range and specific requirements for suitable overwintering sites (hibernacula).[1,2] Little information is currently available on the basic ecology of the eastern yellow-bellied racer in Canada, and its distribution and abundance are poorly documented.

Canadian populations of the eastern yellow-bellied racer in Saskatchewan are at the northern extent of a broad geographic range that is largely in the United States (Fig. 2).[1] Populations of this racer in Canada likely originated from, and may still be connected to, southern populations closer to the core of their range. Previously, the reported range for eastern yellow-bellied racers in Canada only included the Frenchman River Valley and Big Muddy Valley, as these snakes had not been found outside these major river valley systems.[1] However, recent evidence suggests that the eastern yellow-bellied racer may be, or is becoming, more widespread on the Canadian Prairies than was previously thought.

Frenchman River Valley, Saskatchewan

The eastern yellow-bellied racer has long been known to inhabit the Frenchman River Valley in the area within Grasslands National Park; however, formal study of this species in the area only began recently.[3-6] In 2006, the Val Marie Prairie Farm Rehabilitation Administration (PFRA) pasture manager found a road-killed eastern yellow-bellied racer on PFRA land about 12 km NW of the town of Val Marie (T. Platt, PFRA,

pers. comm.). This was the first record of an eastern yellow-bellied racer north of the boundaries of Grasslands National Park. In 2007, researchers and Parks Canada staff began searching for dens and studying the eastern yellow-bellied racer in response to the species being listed as Threatened by COSEWIC in 2004. Research in 2007 on Val Marie PFRA land led to the discovery of the first known hibernaculum to contain the eastern yellow-bellied racer outside of Grasslands National Park. This den was also inhabited by plains garter snakes (*Thamnophis radix*), prairie rattlesnakes (*Crotalus viridis*), and bullsnakes (*Pituophis catenifer sayi*). In 2009, a second hibernaculum housing the eastern yellow-bellied racer was discovered in the same PFRA pasture; this den was also inhabited by plains garter snakes and bullsnakes. For both new dens, it was the radio-tracking of bullsnakes that led to their discovery. As of 2011, there were seven known eastern yellow-bellied racer den sites in the Frenchman River Valley, mainly inside of Grasslands National Park.[7] Recent mark–recapture population size estimates using the Lincoln-Petersen formula (three recaptures of 24 previously marked snakes in a sample of 43 snakes in 2010), suggest that over 300 eastern yellow-bellied racers inhabit the Snake Pit hibernaculum, the largest known den site in Grasslands National Park.

Big Muddy Valley, Saskatchewan

The first eastern yellow-bellied racer found in the Big Muddy Valley in south-central Saskatchewan was caught on a private ranch in 1968.[8] In 1976, a second specimen was found in the same area.[9] These two individual events suggest that eastern yellow-bellied racers occupy the Big Muddy Valley, but they have not been studied in that area, and the extent and size of the local population are completely unknown.[5,6] In May 2010, a road-killed eastern yellow-bellied racer was found (D. Hjertaas, Saskatchewan Watershed Authority, pers. comm.) 36 km NW of the 1968 and 1976 capture sites. This discovery prompted further investigation for potential den sites in the area. A live bullsnake and an eastern yellow-bellied racer were captured in the area later in May of 2010. The bullsnake was implanted with a transmitter and radio-tracked to its hibernaculum in the fall of 2010, resulting in the discovery of the first known den site to contain the eastern yellow-bellied racer outside of the Frenchman River Valley. The new hibernaculum site extended the confirmed distribution of eastern yellow-bellied racers towards the north-western portion of the Big Muddy Valley. In total, three adult eastern yellow-bellied racers and eight adult bullsnakes were found in the area in 2010 (Fig. 3, see outside back cover).

Cypress Hills, Saskatchewan

In 1998, an eastern yellow-bellied racer was observed within 0.5 km of Fort Walsh in the Cypress Hills.[10] To our knowledge, this was the first recorded observation of the species in the area. In 2009, a second observation of a snake that matched the description of an eastern yellow-bellied racer was made 1 km west of Fort Walsh (J. Poissant, University of Regina, pers. comm.), very near the previous sighting from 11 years prior. Combined, these two observations suggest that a previously undocumented eastern yellow-bellied racer population may inhabit the Cypress Hills area. This is significant because it not only suggests a separate, isolated population, but it would also be the only known population to exist outside of a major river valley system in Canada (i.e. Milk, Frenchman, or Big Muddy).

Onefour, Alberta

Since 2001, one probable and four confirmed sightings of eastern yellow-bellied racers have occurred in extreme south-eastern Alberta, near Onefour and

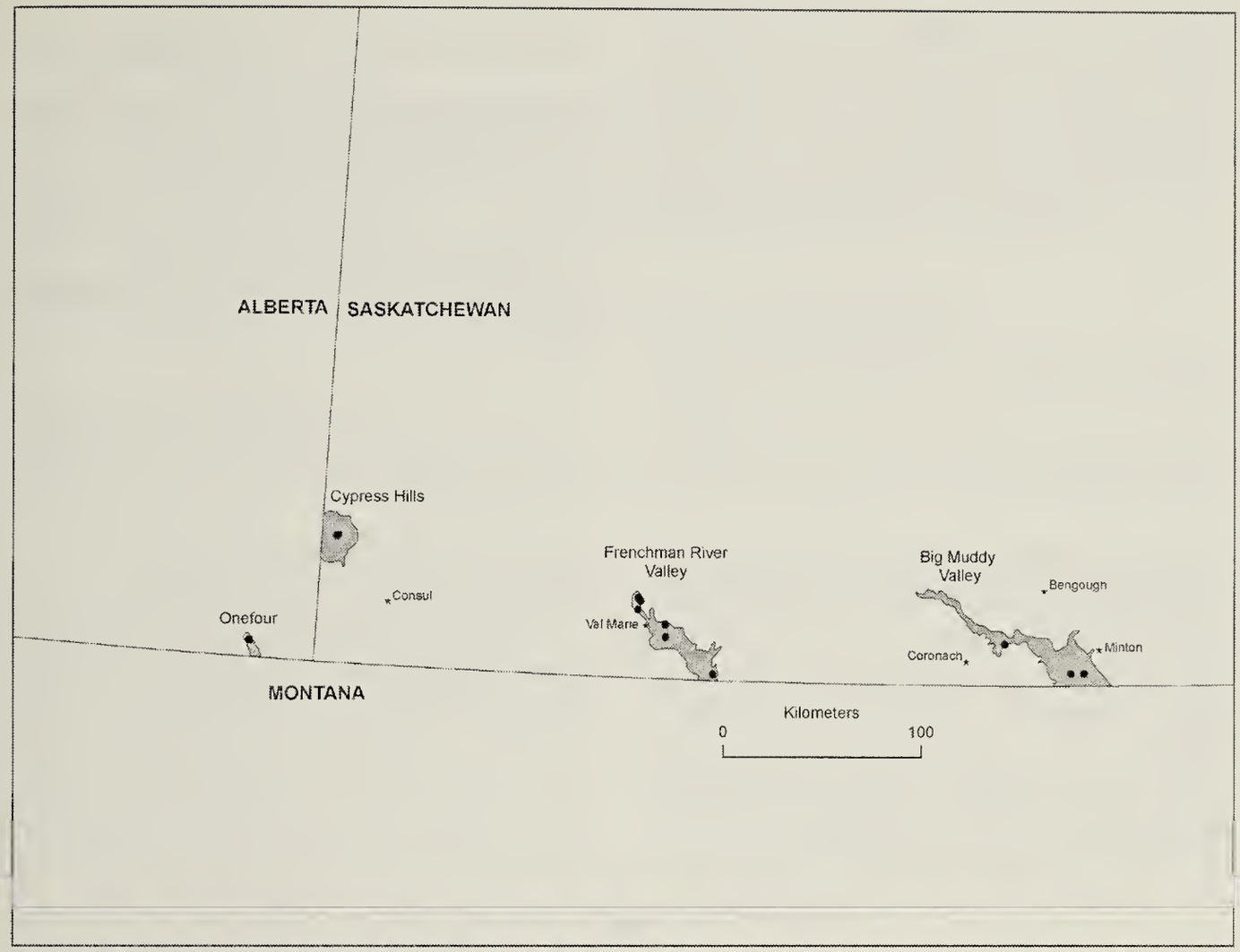

Figure 4. Updated geographic range of the eastern yellow-bellied racer in Canada. Black dots represent confirmed eastern yellow-bellied racer locations; gray shading is the possible area occupied by the eastern yellow-bellied racer based on potentially suitable habitat.

Lost River.[1,7] These are the first known records of eastern yellow-bellied racers in Alberta. These sightings suggest another, potentially separate population in the Canadian Prairies. The first record from Onefour was an observation of a burrowing owl (*Athene cunicularia*) bringing a dead eastern yellow-bellied racer to its burrow.[1] What was left of the specimen was later collected from just outside the burrow entrance on 29 May 2001, and is currently part of the collections at the Royal Alberta Museum (I. Kriston, Royal Alberta Museum, pers. comm.).

Interestingly, there could be four unconnected populations of the eastern yellow-bellied racer in the Canadian Prairies (Fig. 4). Population genetics studies are currently underway to evaluate how the various groups of eastern yellow-bellied racers may be interconnected (C. Somers, unpublished data). Seven known den sites have been identified as critical habitat for eastern yellow-bellied racers within the Frenchman River Valley; however, the observations from Cypress Hills and Onefour, in addition to the den located in Big Muddy Valley, warrant further investigation for den sites in these areas. Recent eastern yellow-bellied racer sightings outside of the Val Marie/Grasslands National Park area may be due to several factors: (a) it is possible that eastern yellow-bellied racers are more widespread and abundant in Canada than previously thought; (b) more search effort may be resulting in the 'discovery' of populations that were

simply unnoticed before; or (c) eastern yellow-bellied racers may be extending their range northward. It is currently impossible to distinguish among these possibilities; there is clearly a need for additional research on this species in Canada.

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American bittern with mouse snack. *Randy McCulloch*

PLANTS

OPHIOGLOSSID FERNS IN MANITOBA: MOONWORTS, GRAPEFERNS AND NORTHERN ADDER'S-TONGUE

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The Ophioglossaceae or adder's-tongue family is a small group of less than 100 species of ferns that are terrestrial or epiphytic and found worldwide.[1] They are quite distinct morphologically from other ferns. Each plant has a single stem that is largely subterranean, and this supports a short-lived, usually single leaf that is composed of two parts: a sporophore that bears sporangia and a photosynthetic leaf blade or trophophore.[1] This morphology contrasts with that of most other ferns, the leptosporangiate ferns, which produce their sporangia on the lower sides of their photosynthetic leaves. The relationship between the ophioglossid and leptosporangiate ferns has been a mystery for many years[2,3]; however, recent DNA research has suggested that the ophioglossids are more closely related to the tropical whisk fern family (Psilotaceae) than they are to the leptosporangiate ferns.[1] Unfortunately, fossil evidence is sparse and we know virtually nothing about the ancestral history of this group. The taxa at the species level have been just as difficult to determine because of the simple morphology and the relative lack of characters.[2]

A new understanding of the taxonomy of this group has allowed the recognition of more species in Alberta and Saskatchewan; however, the numbers recorded for Manitoba have remained low.[4,5] Scoggan, who wrote the classic "Flora of Manitoba" in 1957, recorded four Manitoba species all belonging to a single genus, i.e. common moonwort (*Botrychium lunaria*), daisy-leaf moonwort (*B. matricariifolium*), leathery grapefern (*B. multifidum*), and rattlesnake fern (*B. virginianum*).[6] Since 1957, other species have been added to this list as they were found, but there has not been a systematic examination of specimens from Manitoba.[7,8]

Ophioglossid ferns have no direct economic value;[1] however, knowledge of their abundance and distribution would be as critical a contribution to our understanding of regional biodiversity and conservation needs as it is for any group of organisms. The goal of this study was to determine the taxa occurring in Manitoba, their distributions and relative abundances. To achieve this, it was necessary to study specimens collected within the province and from these records to make an annotated checklist and distribution maps for the taxa. Photographs and an identification key were also considered to be valuable.

Materials and Methods

Specimens of ophioglossid ferns were examined during 2009 and 2010 at the herbaria of The Manitoba Museum (MMMN), University of Manitoba (WIN), and the University of Winnipeg (UWPG). In addition, since 2005 I have prepared a temporary personal research collection

as a result of searching for ferns and lycophytes throughout the province.

Each herbarium specimen was examined, compared with current species descriptions and annotated if necessary.[2,4,9] I followed the nomenclature and taxonomy that recognizes four local genera within the Ophioglossaceae, i.e. *Ophioglossum*, *Botrychium*, *Botrypus*, and *Sceptridium*.[4,10] These genera were separated from each other because of consistently different features (see figures). The moonworts, *Botrychium* spp., have shoots consisting of two parts, a sporophore and a trophophore, no matter their size or age, whereas in the rattlesnake ferns (*Botrypus virginiana*) and grapeferns (*Sceptridium* spp.), the smaller plants do not produce fertile parts. The most obvious difference between rattlesnake ferns and grapeferns is that the trophophore of the former is attached well above ground, whereas that of the grapeferns is attached at or below ground level. Some texts have included *Botrypus* and *Sceptridium* as subgenera of a wider genus *Botrychium*.[9,11] An annotated species list was developed from these herbarium records (see below).

The collection location for each specimen was converted to Universal Transverse Mercator (UTM) coordinates wherever the information on the herbarium label was sufficiently precise. Collection locations were plotted on maps showing grids of 10 × 10 km and also 50 × 50 km squares using the UTM system based on North American Datum 1983 (NAD 83). The distribution maps using 50 × 50 km squares are shown below. Specimens that could not be placed within a 50 × 50 km square due to unclear or imprecise locations were not included in the distribution maps.

Results and Discussion

Two hundred and twenty-two specimens of ophioglossid ferns were examined in total. These consisted of ten species (Table 1), but by far the most numerous were specimens of rattlesnake fern. All members of the genus *Botrychium*, the moonworts, are small and inconspicuous; it is likely that actual differences in the numbers of specimens reflect real differences in their specific abundances. This table also includes the numbers of squares both at the 10 km and 50 km levels, from which specimens of a particular species had been collected. These statistics provide an idea of the distribution, i.e., whether the species is widespread or has a relatively restricted range.

An exciting outcome of this study is that several taxa, including spatulate moonwort (*Botrychium spathulatum*) and least moonwort (*B. simplex*), were recorded for the first time in Manitoba. The first of these species had been collected in the province before the taxon was officially recognized as being different from the common and Mingan moonworts. Blunt-lobed grapefern (*S. oneidense*) and prairie moonwort (*B. campestre*) had been reported recently but were essentially new finds for the province.[12,13] Species that were recorded for the second time only include: northern adder's-tongue (*O. pusillum*), daisy-leaf moonwort (*B. matricariifolium*), and spatulate moonwort (*B. spathulatum*).[12,13]

I was unable to locate specimens of pale moonwort (*B. pallidum*), which had been observed in the Otterburne area in south-central Manitoba.[8,14] It was not possible to confirm that this species occurs in the province in the absence of specimens and should remain as "of hypothetical occurrence" for the present.

The criteria that I found useful in identification were: shape of the trophophore and its pinnae, attachment point of the trophophore to the sporophore, degree of branching of the sporophore, habitat, phenology of spore production, and distribution.

Table 1. Numbers of specimens of ophioglossid ferns in Manitoba herbaria (MMMN, UWPG, WIN, and author's collection), numbers of UTM squares in which the specimens were collected out of 6068 squares (10 ×10 km) and out of 323 squares (50 × 50 km), and rankings according to NatureServe Canada.[15] NatureServe Conservation Status Ranks are as follows: G=Global, S=Subnational (i.e. province of Manitoba), 1=Very rare, 2=Rare, 3=Uncommon, 4=Abundant with possible unknown threats, 5=Abundant and secure, SNR=Species not ranked

Common Name	Herbarium specimens	10 × 10 km UTM squares occupied	50 × 50 km UTM squares occupied	Conservation Status Ranks
Rattlesnake fern	149	98	52	G5, S5
Common moonwort	30	16	14	G5, S4
Leathery grapefern	17	14	13	G5, S3
Mingan moonwort	15	10	9	G4, S1S2
Northern adder's-tongue	3	2	2	G5, S1
Daisy-leaf moonwort	2	2	2	G3G4, S1
Spatulate moonwort	2	2	2	G5, S1
Prairie moonwort	2	1	1	G3, SNR
Least moonwort	1	1	1	G5, SNR
Blunt-lobed grapefern	1	1	1	G4, S1
Pale moonwort	0	0	0	G3, S1

It is clear that ophioglossid ferns are rare in Manitoba, with the notable exception of rattlesnake fern, which is both widespread and tolerably common. The remaining species are considered scarce at the provincial level based on criteria used by NatureServe Canada, as is shown by the Conservation Status Ranks given in Table 1.[15]

The question of whether to collect specimens of rare ophioglossids can and should be considered. On one hand, specimens are essential for verification, especially for a group of morphologically similar taxa which may continue to undergo taxonomic revision. On the other hand, it would be difficult to justify putting populations at risk by collecting individuals. Fortunately, the removal of the leaf after spores have been dispersed and the above-ground plant parts have started to senesce would seem to have little more effect than the removal of fall leaves from a deciduous shrub or tree, as long as the underground stem does not get damaged in the process. Any specimens collected should be donated to a herbarium along with the collection date, location, and habitat information to ensure their long-term care, storage, and research availability.

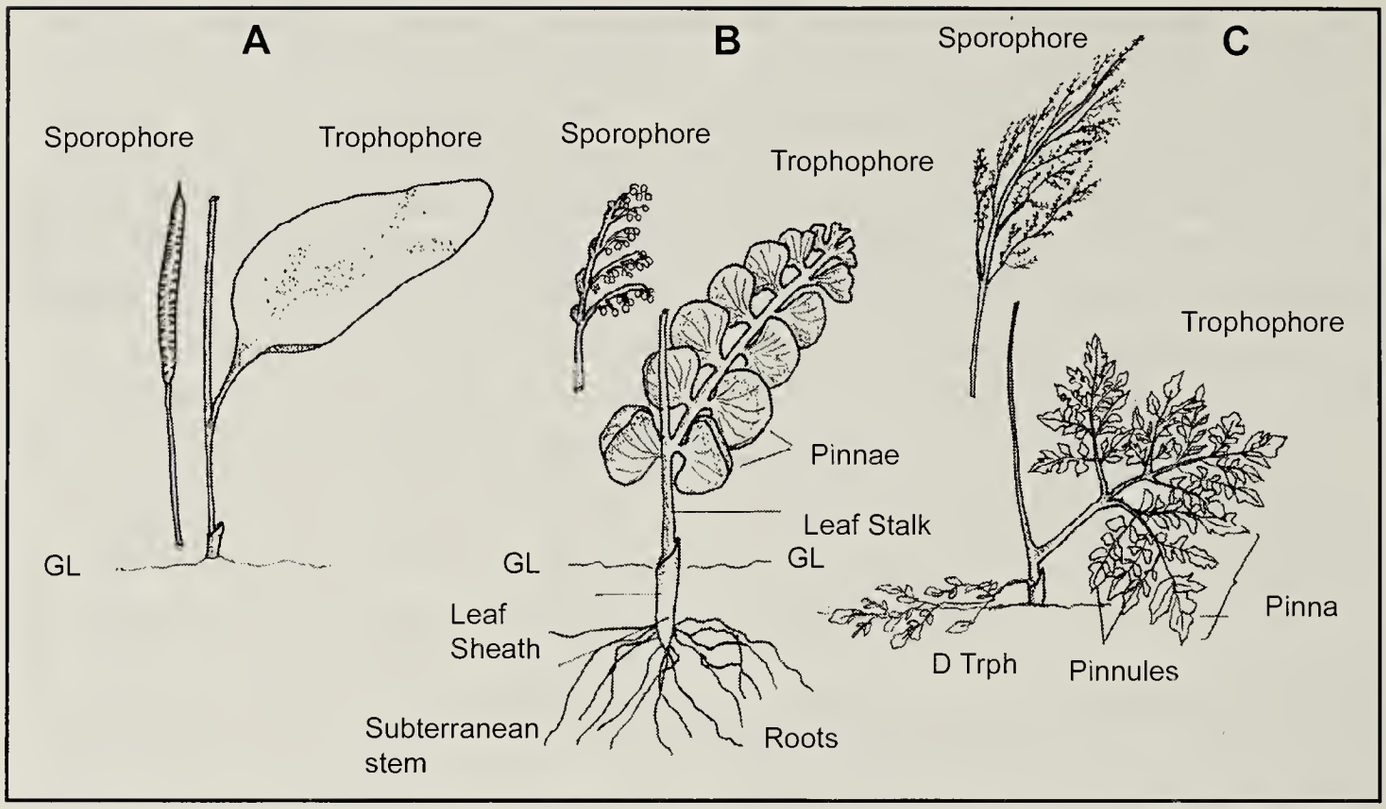


Figure 1. Terminology and morphology of ophioglossid ferns. (A) Northern adder's tongue with simple (= undivided) trophophore (leaf blade) with entire (= untoothed) margin. Its sporophore (fertile portion) is also simple (lacking branches), and its sporangia are embedded in its matrix. (B) Common moonwort with its pinnate compound leaf with paired, fan-shaped pinnae (leaflets). Its sporophore is branched and supports clusters of spherical sporangia. (C) Leathery grapefern with its deltoid (triangular) trophophore which is divided into pinnae and these divided again into pinnules (sub-leaflets) which are in turn divided a third time, i.e. the trophophore is thrice-compound. In this case, the sporophore is much branched and supports large clusters of sporangia which resemble bunches of grapes. Other terms: GL=ground level, d Trph=dead overwintering trophophore. Note that the three drawings are not drawn to the same scale.

Key to genera and species of ophioglossid ferns found in Manitoba

See Fig. 1. for illustrations of terms and morphology of ophioglossid ferns.

1a. Trophophore (sterile leaf section) single, simple with entire margins; sporangia sessile and embedded in a spike-like sporophore (fertile leaf portion).....*Ophioglossum pusillum*

1b. Trophophores 1-4, compound; sporangia arranged on branched sporophores..... 2.

2a. All stems are fertile; fronds once-divided or twice-divided, deciduous .....*Botrychium* (go to 5)

2b. Some stems without sporophores; fronds 2-4 compound, evergreen or deciduous ..... 3.

3a. Fronds deciduous; blade attached to stalk near middle .... *Botrypus virginianus*

3b. Fronds evergreen; blade attached at ground level .... *Sceptridium* (go to 4)

4a. Terminal pinna (leaflet) similar in size to lateral pinnae, divided to near their tips .... *Sceptridium multifidum*

4b. Terminal pinna of trophophores larger than laterals; not divided near their tips .... *Sceptridium oneidense*

5a. Distance between 1st and 2nd pairs of pinnae greater than between 2nd and 3rd pairs, 1st pair of pinnae often divided into leaflets, terminal pinna broad.....*Botrychium simplex*

5b. Distance between 1st and 2nd pairs of pinnae hardly or not greater than between 2nd and 3rd pinnae..... 6.

6a. Pinnae deeply segmented, with midrib (central vein) and lateral veins .... *Botrychium matricariifolium*

6b. Pinnae entire, toothed or coarsely dentate but not deeply segmented, with fan-like veins and no midrib....7.

7a. Basal pinnae wide (>120°) and fan- or kidney-shaped; pinnae usually overlapping ..... *Botrychium lunaria*

7b. Basal pinnae narrowly fan-shaped (<90°), or not fan-shaped; pinnae not usually overlapping..... 8.

8a. Trophophores folded lengthways with up to 5 pairs of pinnae ..... 9.

8b. Trophophores not folded lengthways and up to 10 pairs of pinnae..... 10.

9a. Pinnae very fleshy, basal pinnae linear with wide bases and symmetrical lobes, plant pale yellowish-green..... ..... *Botrychium campestre*

9b. Pinnae not fleshy, basal pinnae more or less fan-shaped with asymmetric lobes, plant whitish in colour ....*Botrychium pallidum*

10a. Trophophore narrow and oblong, pinnae shallowly lobed; lower branches of sporophore once-divided .... *Botrychium minganense*

10b. Trophophore narrow and triangular, pinnae entire to coarsely toothed; lower branches of sporophore at least twice-divded ....*Botrychium spathulatum*

Annotated checklist of ophioglossid ferns found in Manitoba

Photographs and distribution maps are shown in Figs. 2–6. Note: certain species of ophioglossid ferns occur in Saskatchewan or Alberta that have not been reported for Manitoba.

Prairie moonwort, *Botrychium campestre* W. H. Wagner & Farrar

A single plant was discovered along a gravelly trail edge in Bird's Hill Provincial Park, S Manitoba by R. Staniforth in May 2005 and then reappeared during the following three springs, but not seen afterwards.[12,13] Aerial parts appeared in late May or early June and had senesced by late June and early July. This is a species of prairies and dry places in the northern Great Plains with isolated populations around the Great Lakes and elsewhere in North America.[9] It has been reported from Alberta and Saskatchewan.[4,5] Prairie moonwort was originally described in 1981.[9]

Common moonwort, *Botrychium lunaria* (Linnaeus) Swartz

This moonwort is found throughout the northern half of the province but is scarce, except along the Hudson Bay coastline, where it is locally abundant on damp, exposed substrates, such as old sand and gravel pits.[16] Double trophophores, triple sporophores, and fertile pinnae have been recorded among plants from the Churchill area.[17,18] Sporangia ripen from mid-July to early September. Specimens from southern Manitoba are now considered to belong to other species. The most northerly Manitoba collection was from Seal River and the most southerly specimen from Playgreen Lake near the north end of Lake Winnipeg. It is widespread in northern and western North America, as well as in many other parts of the world.[9] It occurs in both Alberta and Saskatchewan.[4,5] This taxon was originally described in 1801.[9]

Daisy-leaf moonwort, *Botrychium matricariifolium* (Döll) A. Braun ex W.D.J. Koch

Only two specimens have been collected from the province, both from boreal granite

outcroppings in central Manitoba. H. Scoggan collected immature specimens from Norway House on 24 June 1948.[6] The second Manitoba specimen with ripe, dehisced sporangia was found by R. Staniforth in late July 2007 in Wekusko Provincial Park.[12,13] This species was first described in 1847 and is found in boreal regions across North America and Europe.[9] It occurs in both Alberta and Saskatchewan.[4,5]

Mingan moonwort, *Botrychium minganense* Victorin

In Manitoba, the Mingan moonwort is of widespread but rare occurrence in forest clearings or in mixed forests.[6] In Manitoba, sporangia ripen from mid-July to late August. The most northern specimens were collected from Goose Creek, near Churchill, and the most southern specimen was from Elm Point on Whitemouth Lake, SE Manitoba. This species is found across the northern and western regions of North America.[17] It is found in both Alberta and Saskatchewan.[4,5] Mingan moonwort was first described as a new species in 1927.[9]

Pale moonwort, *Botrychium pallidum* W.H. Wagner

This species was included in a provincial plant list on the basis of a report from Otterburne, southern Manitoba.[8,14] No voucher specimen has been seen and therefore its occurrence in Manitoba requires verification. It is a species of the Great Lakes region with disjunct populations elsewhere.[9] This species has also been reported from Alberta, but not from Saskatchewan.[4,5] This taxon was first described as a valid species in 1990.[9]

Least moonwort, *Botrychium simplex* E. Hitchcock

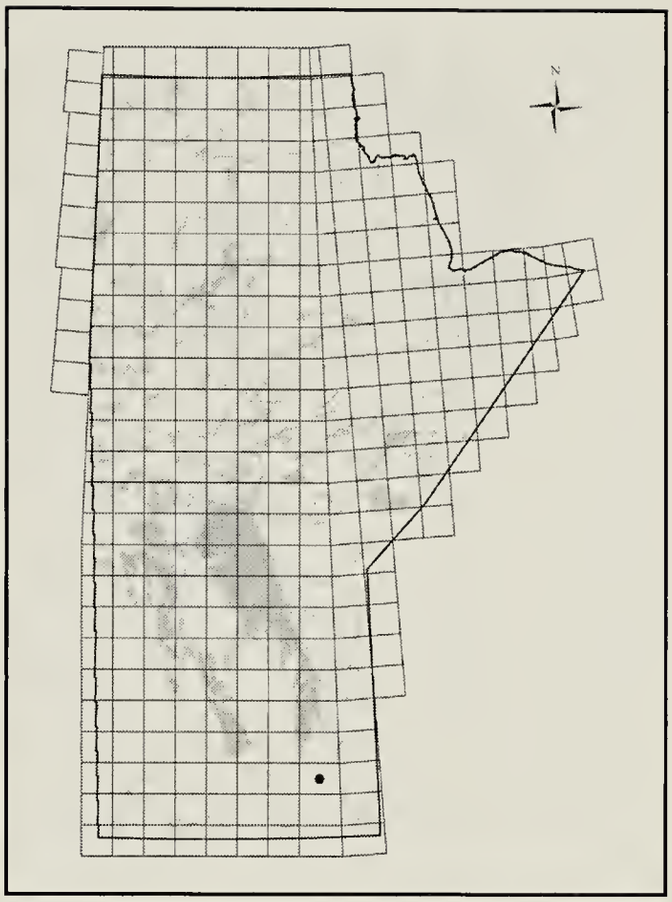
A single specimen is the only record for Manitoba.[13] It was collected on 13 June 1994 by B. Ford, J. Starr, and E. and D. Punter from a sandy road convergence in a jack pine forest, near Badger, SE Manitoba. In common with the prairie and daisy-leaf moonworts, this is an "early-season" species; the spores of the Badger specimen were already ripening in mid-June. The least moonwort is found in both western and eastern North America, as well as in Europe.[9] The Badger specimen is NW of its known eastern range which extends into northern Minnesota and NW Ontario.[19] The species has also been reported from Alberta and Saskatchewan.[4,5] The species was first described in 1823.[9]

Spatulate moonwort, *Botrychium spathulatum* W.H. Wagner

A plant from Riding Mountain National Park collected in 1940 by C. Lowe was the first collection of this species from Manitoba. A second colony of about 2000 plants was discovered on a mud airstrip at Lake Waskaiowaka, north of Split Lake on 9 July 2010 by R. Staniforth.[13] The plants were almost mature, and it is likely that sporangia would have been ripe by the end of July. This species occurs as several widely scattered populations in northern North America.[9] This species has also been reported from Alberta, but not from Saskatchewan.[4,5] The spatulate moonwort was not recognized as a distinct species until 1990.[9]

Rattlesnake fern, *Botrypus virginianus* (Linnaeus) Holub, synonym: *Botrychium virginiana* (Linnaeus) Swartz

This is the most widespread and common member of this group of ferns in Manitoba. It is found in clearings and on disturbed soils in deciduous, mixed, and coniferous forests throughout most of the province except the far north. The most northern specimen had been collected from Lake Waskaiowaka, north of Split Lake. In Manitoba, the plants appear in June, and aerial parts are senescent by mid-September. The species was originally described in 1801, and is widespread



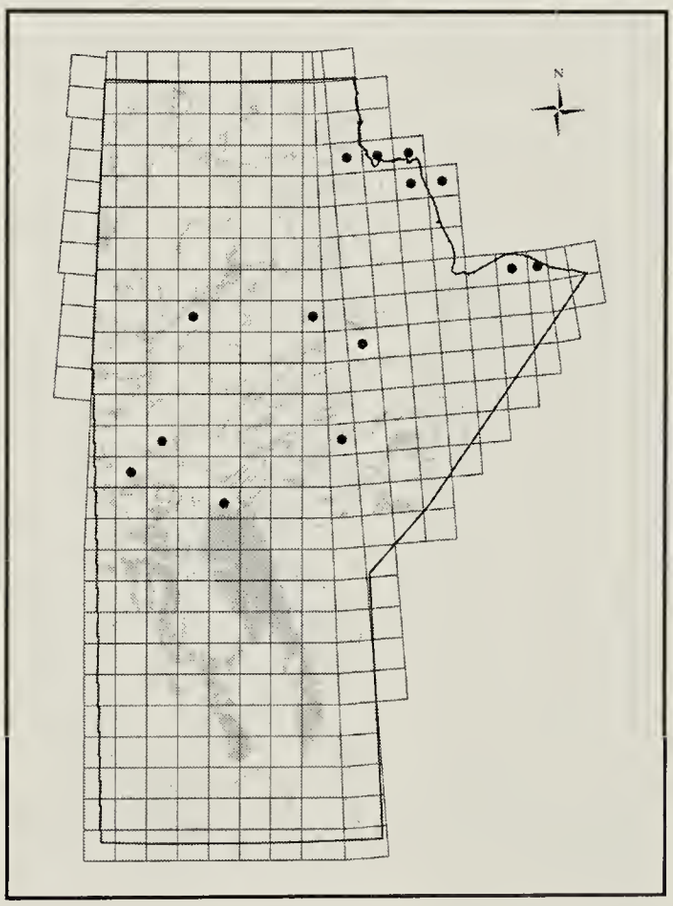
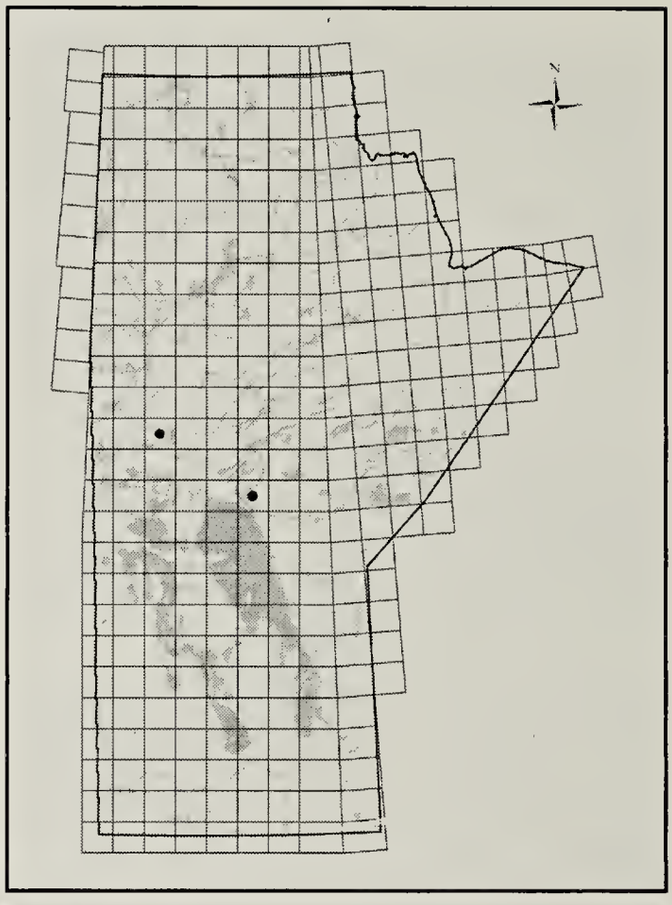
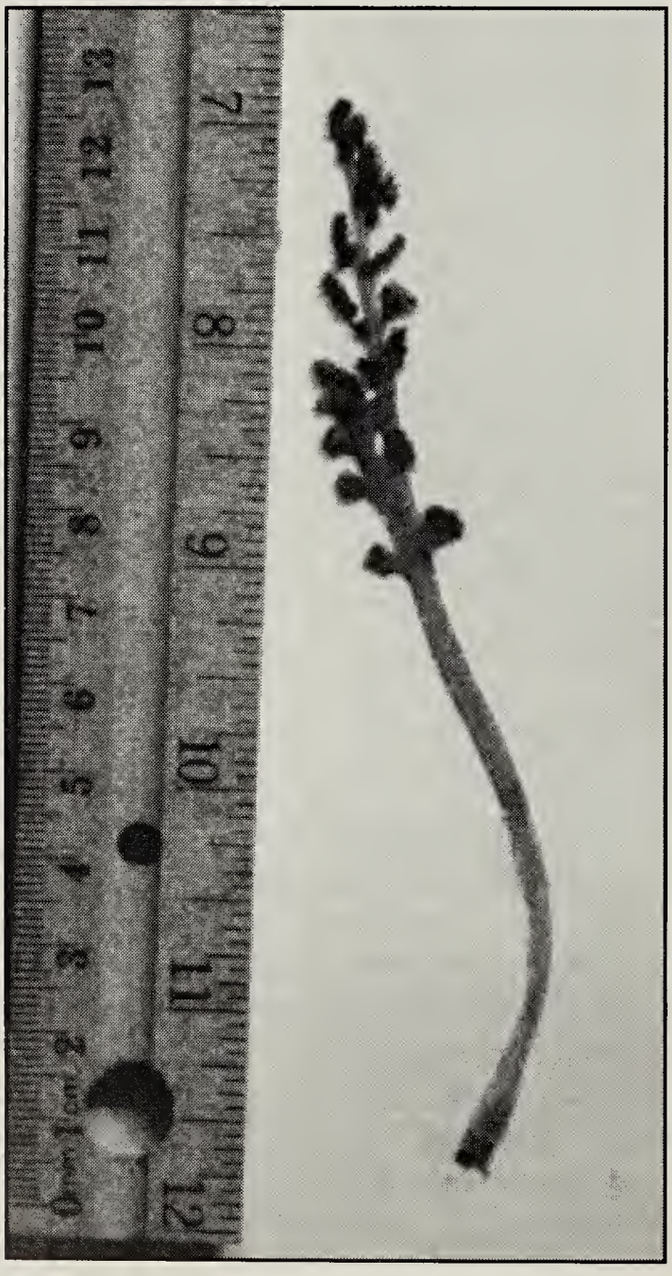


Figure 2. Upper photograph and map: prairie moonwort, Botrychium campestre*, Bird's Hill Provincial Park. Lower photograph and map: common moonworts,* Botrychium lunaria*, Churchill. All photographs in Figs. 2–6 were taken by Richard Staniforth, and the maps were made by Colin Murray.*





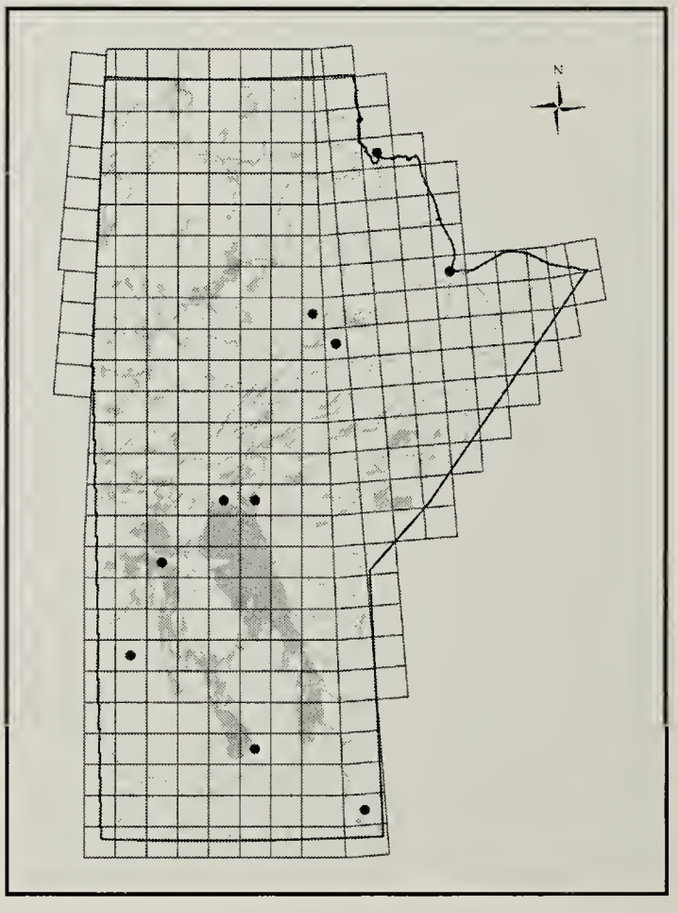
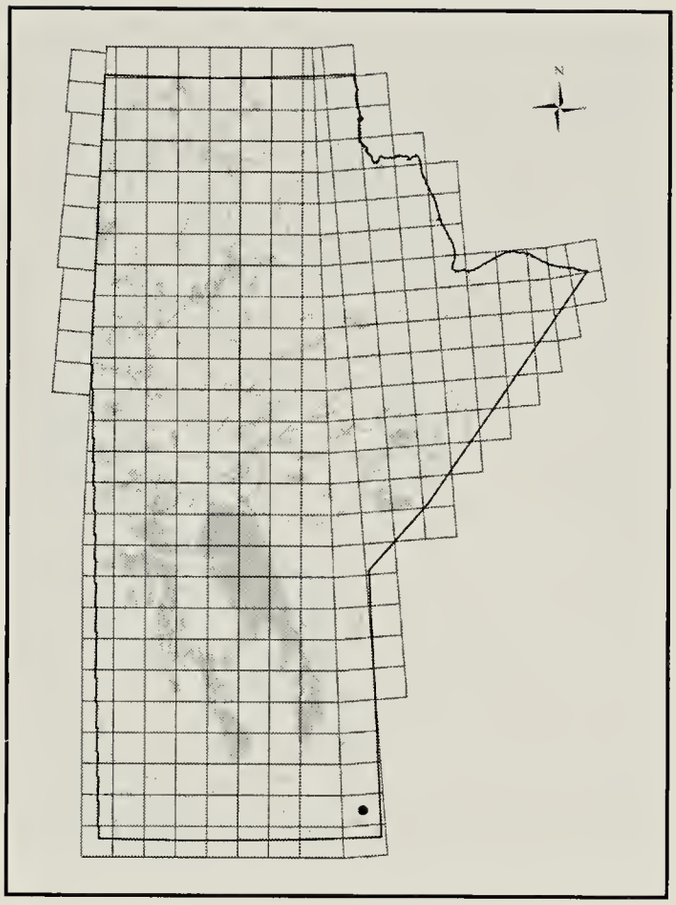
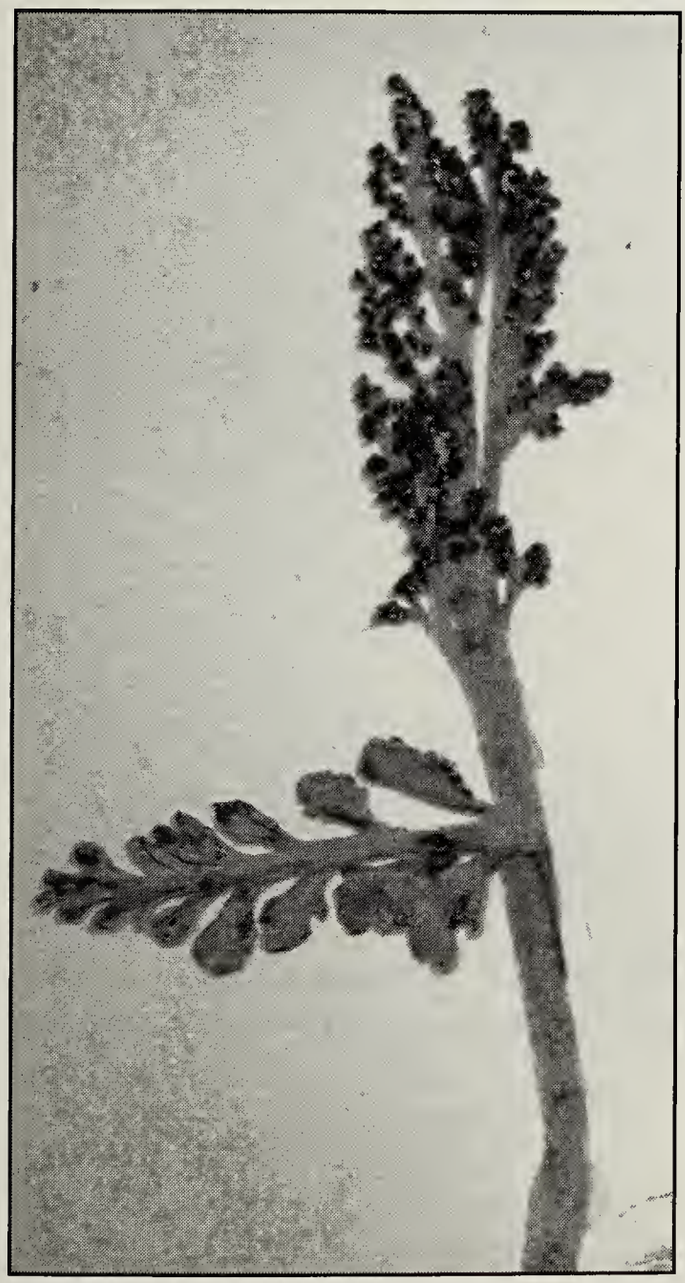


Figure 3. Upper photograph and map: daisy-leaf moonwort, Botrychium matricariifolium, *Wekusko Provincial Park. Lower photograph and map: Mingan moonwort,* Botrychium minganense, *Lake Waskaiowaka.*





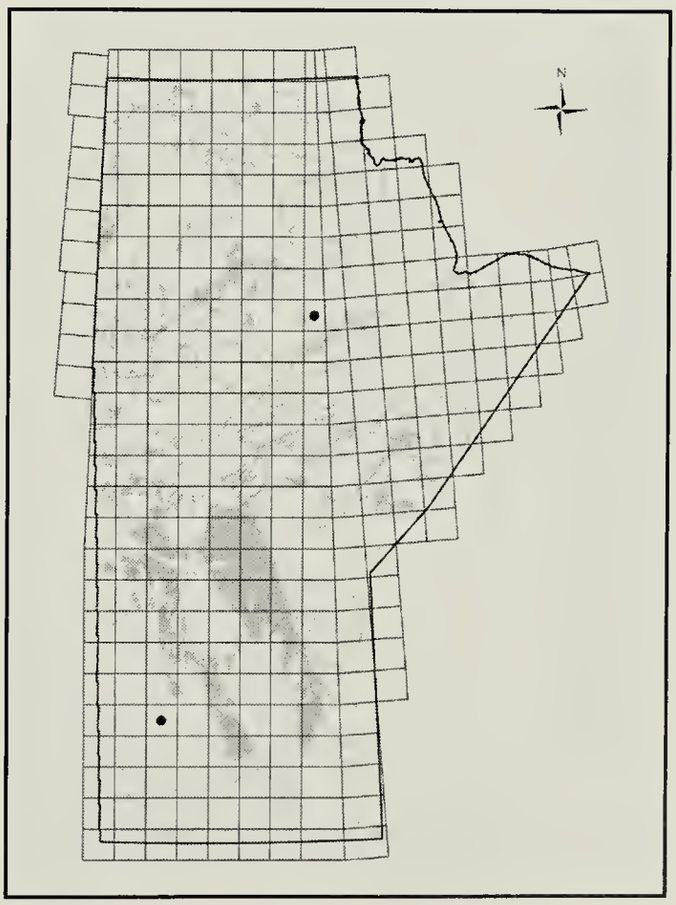
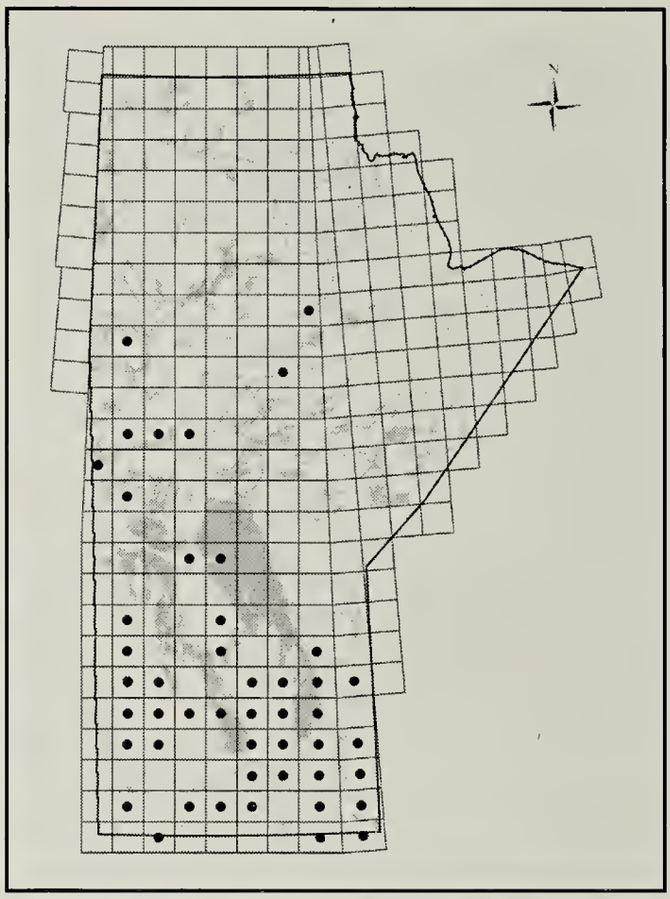
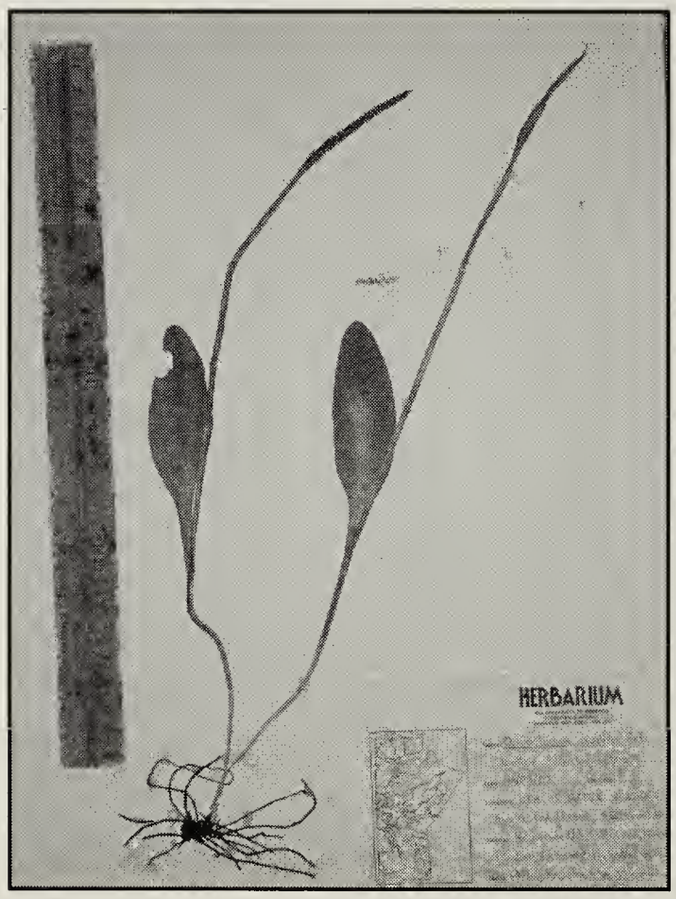


Figure 4. Upper photograph and map: least moonwort, Botrychium simplex, *Badger. Lower photograph and map: spatulate moonwort,* Botrychium spathulatum, *Lake Waskaiowaka.*





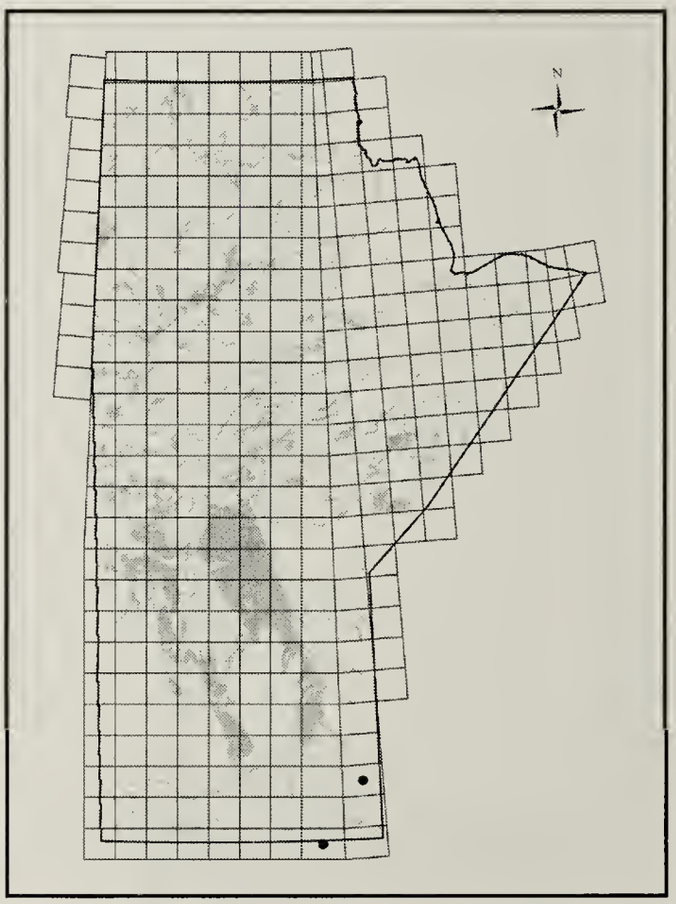
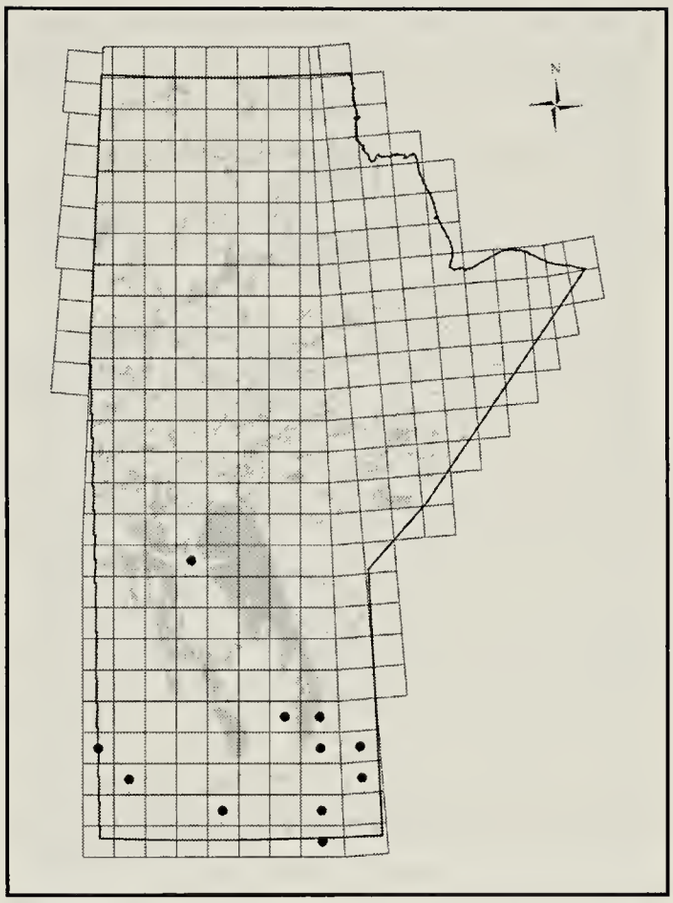


Figure 5. Upper photograph and map: rattlesnake fern, Botrypus virginiana, *Hecla Provincial Park. Lower photograph and map: northern adder's-tongue,* Ophioglossum pusillum, *Rennie.*



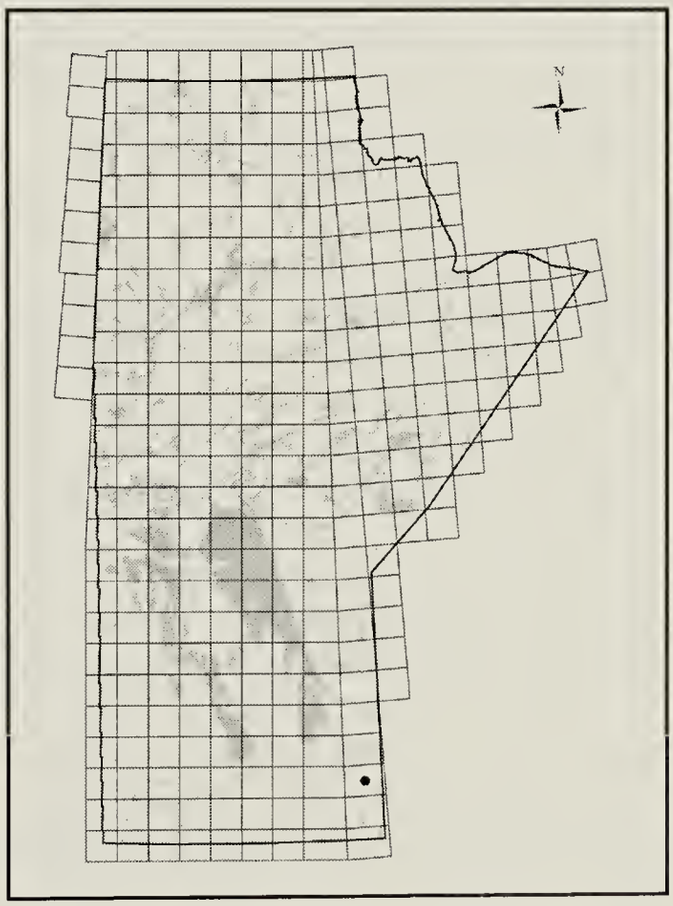


Figure 6. Upper photograph and map: leathery grapefern, Sceptridium multifidum, *Libau. Lower photograph and map: blunt-lobed grapefern,* Sceptridium oneidense, *Star Lake.*

throughout North America and on other continents, except for arid and arctic regions.[9] This species is also common in both Alberta and Saskatchewan.[4,5]

Northern adder's-tongue, *Ophioglossum pusillum* Rafinesque

An extensive, well-populated colony was discovered in 1996 in a wet swale near Vita, southern Manitoba, by L. Reeves.[20] A second colony of about 200 individuals was found in a ditch near Rennie, SE Manitoba, on 9 September 2008 by R. Staniforth.[13] Aerial shoots do not appear until mid-July, and sporangia ripen in September.[20] Populations of this species occur in both eastern and western North America[9], but it has not yet been reported from either Alberta or Saskatchewan.[4,5] The Manitoba populations have extended the known range of the eastern populations in a NW direction from NW Ontario and northern Minnesota. Northern adder's-tongue was described for the first time in 1814.[9]

Leathery grapefern, *Sceptridium multifidum* (S.G. Gmelin) Nishida ex Tagawa, synonym: *Botrychium multifidum* (S.G. Gmelin) Ruprecht

The leathery grapefern is a rare but widespread species in southern and central Manitoba. In Manitoba, this species is usually associated with jack pine–bearberry forests on sandy substrates. The most northerly specimen seen was from Grand Rapids. In Manitoba, the sporangia ripen in late August and September, and the foliage remains green over winter and senesces during the following spring. The species is found across northern North America and northern Eurasia.[9] This species has also been reported from Alberta and Saskatchewan.[4,5] Leathery grapefern was described as a new species in 1859.[9]

Blunt-lobed grapefern, *Sceptridium oneidense* (Gilbert) Holub, synonym: *Botrychium oneidense* (Gilbert) House

A single plant was recovered from ditch excavations among willows and alders, near Star Lake, Whiteshell Provincial Park, SE Manitoba on 25 September 2001 by R. Staniforth, K. Jones, and R. Cormack.[12,13] This plant was mature and bore ripe spores when collected. This species is found across eastern North America westward to Minnesota.[9] It has not yet been reported from either Alberta or Saskatchewan.[4,5] The Star Lake plant is a NW extension of its known range. This taxon was first recognized in 1905.[9]

Acknowledgements

I am very grateful to Diana Bizecki Robson and Janis Klapecki at The Manitoba Museum, and to Bruce Ford and Elizabeth Punter at the University of Manitoba for allowing me to study their Manitoba fern collections. I am grateful to the anonymous reviewer whose thoughtful suggestions greatly improved the manuscript. A large "thank you" also goes to Colin Murray for his patience and expertise in converting a mass of GPS coordinates into elegant distribution maps. The project would have included serious errors had it not been for the willingness of Don Farrar and Patrick Williston to share their knowledge and to make suggestions for specimens that had given me difficulties. I also thank Melissa Hoffer and Liza McClintock for their undergraduate studies on *Botrychium* spp. in Manitoba.[21,22]

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Humankind has not woven the web of life.
We are but one thread within it.
Whatever we do to the web, we do to ourselves.
All things are bound together.
All things connect.

- Chief Seattle, 1854

NATURAL HISTORY

RETURN OF THE GOLDEN BIRD: THE LAST BREEDING GROUND OF THE WHOOPING CRANE ON THE PRAIRIES

James K. Finley

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When I was a boy, the biggest thrill of traveling the long road to Regina was to visit the Saskatchewan Natural History Museum. I was deeply impressed by the spectacular wildlife dioramas and could strongly relate to the scenery, particularly those with broad expanses of marshes populated by exquisitely-mounted specimens of waterfowl, shorebirds, and cranes. I was especially thrilled by the spectacle of the pair of whooping cranes standing on their nest with two eggs and could practically smell the rich alkali aroma of the big sloughs I knew so well at home. As a memento, I avidly collected all the postcards of the dioramas, and when I got home enrolled in the Omaha School of Taxidermy, like many young prairie hunter-naturalists, and took up mounting and drawing birds, dreaming that I might some day become a museum artist and taxidermist. Never could I have imagined how deeply the diorama of the whooping cranes would touch my life; the scene literally formed the backdrop of my life, as it represented Shallow Lake, in the R.M. of Progress pasture, 9 km southeast of Luseland (see Fig. 1, inside front cover, top).

It was the scene of my first illegal act. Armed with a 20-gauge shotgun, alone at the tender age of about twelve, I shot a sandhill crane, long before they were legal to hunt. I can recall the moment like it was yesterday. My dad had stashed me in a buckbrush patch along the pasture fence-line on the north side of Shallow Lake, while he and the men 'pitted in' with decoys in the adjacent field. At dawn, as the thrilling cacophony of geese filled the air, and guns were blazing, I found myself in the flight path of cranes flying low over the pasture, uttering their evocative calls. In my excitement, I shot one and it fell just inside the fence, within the no-hunting zone. Immediately I became scared, worried that my dad had seen my action from afar, so after waiting for the hunt to end, I walked casually by the crumpled grey form, lying in the alkali dust, keeping a nervous eye out for the game warden who was a friend of my dad. I kept my misdeed to myself until now, just like my grandfather, who had committed a more serious violation 40 years earlier, not far away.

They were whooping cranes, he confided a few years before he died, indicating that he had photographs to prove it. I'd seen many of his photographs from pioneering days, posing with his hunting partners with strings of game birds strung on his model T Ford. They showed a mixed bag of waterfowl, including tundra swans, and 'chickens' or sharp-tailed grouse, but he never

Figure 2. Two whooping cranes shot at Buffalo Coulee, 1922, photographed at Loverna, Saskatchewan.

revealed the whooping cranes. I recall only that he had said that he and his friend had mistaken the birds as they flew at dawn out of Buffalo Coulee, silhouetted against the sun, and that a local farmer had been very angry about the killing of the cranes, which had nested there every year.

The incriminating evidence lay at the bottom of his box of photographs until he died in 1971, at which time I was at the University of Saskatchewan studying biology. I found two photographs, partially double-exposed, showing two adult cranes, held up by their necks by a man and boy. My family didn't recognize them but the little girls holding the wing tips of the cranes were my aunts and the daughter of my grandfather's friend, Joe Perry, with whom he had once been in business in Loverna (Fig. 2). Fortunately, Mr. Perry was still alive and I wrote to him in Ladner, BC, asking whether he recalled the incident. He returned a kind letter about his life-long friendship with my grandfather, recalling the halcyon days of the old west, when they hunted in the vicinity of Loverna. Regarding the whooping cranes, he wrote:

"It was early and quite dark and we were pitted for geese, when up against the horizon loomed three big birds. So we killed two dead and number three went away in the dark also hit - we couldn't find it. We really didn't know they were so scarce - took them with us to Kerrobert and were informed by Hanbidge, who said the game department might want to hang us for the crime. We gave one away and the people told us, they cooked the bird for four hours, then it was so tough they fed it to the dog. They had raised one young one which was a golden color the first year, but it never came back the following spring. That balances up with the old Indian legend about the Golden Bird that never returned."

Hanbidge, I learned, was the lawyer and judge in the town of Kerrobert, who

later became the Lieutenant Governor of the province. My grandfather had 'stumped' for him in support of a marketing cooperative that was to become the Canadian Wheat Board. I assumed that the scene of the crime was Kerrobert, and published one of the photographs along with Mr. Perry's comments in the Blue Jay in 1972, entitled laconically, "A 1921 photo of Whooping Crane".[1] The photograph was widely published by various conservation organizations at a time when the environmental movement was taking off, and the whooping crane was the poster species of our past misdeeds. I felt some guilt about besmirching my grandfather's and Mr. Perry's reputation but believed the revelation could serve a conservation purpose. I hadn't heard Mr. Perry's Indian legend about the Golden Bird that never returned, though it sounded ominous.

In 2002, I retraced my grandfather's early history to the ghost village of Loverna and the scene of his crime at Buffalo Coulee (Street Lake on the topographical maps), 22 km straight south of Luseland. After homesteading at Buffalo (near present-day Zealandia), he had invested in an implement dealership with Mr. Perry at Loverna in 1912, anticipating that it would become a boom-town with the new Canadian Northern railway line, but after the Great War his business went bankrupt, and he returned to his homestead in 1918. Numerous photographs, often with the Hotel Vernon as backdrop, attested to his hunting exploits and excessive slaughter, common amongst pioneers, culminating with the whooping crane incident. By this time, he had started over again with an implement dealership in Luseland. Evidently he and Mr. Perry had met to hunt geese at Buffalo Coulee, between the two towns, where they killed the cranes and took them back to Loverna. With the photographs, showing an elevator and water tower in the background, I was able to place the scene exactly. Judging from the age of my aunts, born in 1918 and 1919, the event took place in 1922, not 1921 as Mr. Perry had thought. Although he implied that they had mistaken the birds when they 'loomed up' against the horizon, and pleaded that they didn't know how scarce they were, I suspect they were more culpable than they let on. Both wings of one of the birds were broken, indicating that the encounter had occurred at close range. Moreover, they were the only photographs in which neither my grandfather nor Mr. Perry posed.

The scene at Loverna unfolded in the same year that the last nests of whooping cranes on the prairies were discovered by the province's first Game Guardian, Neil Gilmour, at Shallow (Baliol) Lake, and by Fred Bradshaw, the Game Commissioner and first curator of the provincial museum, at Kiyui (Eagle) Lake near Kindersley. In his annual report, Gilmour had described at great length his discovery of the whooping crane's nest, and his photographs and descriptions of the extensive marsh habitat were closely studied by R.D. Symons, who created the magnificent diorama that had inspired me as a boy.[2]

At the time, it was practically a foregone conclusion that whooping cranes were doomed. A.C. Bent considered Gilmour's discovery one of the most important nest finds in North America, devoting an extraordinary two pages to his account in *Life Histories of North American Birds* of 1926, as if it was a eulogy for the species.[3] Percy Taverner, in the *Birds of Western Canada*, published in the same year, did not hold out much hope either, stating that "The last chance of preserving this, probably the most spectacular birds of the prairies, depends entirely upon the people of the prairies. All localities cannot be watched by wardens and no game laws

are capable of 100 per cent enforcement. If occasional birds are killed it will matter little to the species that the offender is caught and punished, for the irreparable damage will have been done. Laws can do little for a case like this, but an aroused public opinion is much more efficient."[4] As R.D. Symons noted, "[Neil] Gilmour spoke in hundreds of rural schools and was indefatigable in spreading the gospel of conservation."[2] Undoubtedly my grandfather's friend 'Dinny' Hanbidge, who was also an avid hunter, was aware of the rarity of the whooping crane, as Gilmour had probably targeted the Kerrobert area with his message, and had depended on a local family, the Smiths, who had informed the Game Commissioner's office about the cranes.[5] No doubt my grandfather heard Gilmour's message through Hanbidge and the irate farmer at Buffalo Coulee who had taken a strong interest in protecting the cranes. But the damage had been done, more birds were shot, including ones by the Smiths, and the whooping cranes disappeared from their last breeding ground in western Saskatchewan by the end of the 1920s.[6]

As with the demise of the buffalo, the growing publicity of the plight of the whooping crane may have hastened its extirpation on the prairies, through curiosity and a sense of posterity. There are numerous legends about who killed the last buffalo in the wild, and as the cranes were headed the way of the passenger pigeon, their skins and eggs became highly sought after by collectors.[7] Like Hornaday's overzealous ambition to collect the last wild buffalo for preservation in the American Museum of Natural History,[8] Fred Bradshaw collected the eggs and a newly hatched chick at Kiyiu Lake. (Note that the location was misattributed to Muddy Lake and has since been widely perpetuated in the literature). At the same time, Bradshaw and Gilmour were preaching the gospel of conservation and calling for tough action against poachers. The hypocrisy of Bradshaw's actions would not have been lost on the farm family he had lodged with, unless he did not tell them. Like my grandfather, he kept his act secret, describing the chick's last moments as he tried to photograph it, before collecting it - "to give it immortality in the form of a tag with a number on it", as crane biologist Robert Allen described it.[7,9] At first, the chick didn't cooperate, "stretching itself flat on the nest in a limp lifeless-looking form. Eventually it manifested a lively concern in its new world and the shutter clicked making a photographic record of Whooper Junior as he appeared on his birthday."[5] A recent article in Audubon Magazine described that day, May 30, 1922, as the "epitome of how humanity nearly preserved Whooping Cranes to death".[7]

Recently, while flipping through the pages of our local history books, published by the Luseland Historical Society in 1983, I was surprised to come across a reference to the whooping cranes at Shallow Lake. The account was written by Jean Norris, daughter of William Smith, who homesteaded in 1910 along with his brothers near Kerrobert.[10] One of his brothers, Archie, "filed on S.E. 2-35-24-W3 on the south side of Shallow Lake, commonly called Baliol slough, one of the last known nesting sites of the Whooping Crane in Saskatchewan." Her mother recalled two "outstanding" incidents:

"When the H.D. Smith family came to Kerrobert, the boys decided they would like a pet so John, who was a great athlete, and Will undertook the project of catching two young Whooping Cranes by running them down on foot. They tamed the birds and wintered them in the henhouse. In those cramped quarters the birds fought and later one crane died.

The surviving crane became a great pet. One day a cunning coyote sneaked up to the trees, and killed the bird, much to the sorrow of the family."

and

"The time Will shot a Whooping Crane, and had Mrs. Norman MacDonald mount it. The bird presently is on display in the Museum of Natural History in Regina."

These second-hand recollections, oral history passed down over 60 years, are not fully in agreement with the original records by Gilmour.[6] Archie Smith had guided Gilmour, the game guardian, to the nest and provided valuable notes about the small flock that inhabited the marshes from the time he homesteaded there in 1911 until the last of them disappeared in 1929, due to occasional shootings, and ultimately when the big marsh dried out in the Dirty Thirties. Hjertaas chronicled this history along with all known records of breeding cranes on the prairies.[6]

Whatever the proverbial outcome of Joe Perry's legend about the Golden Bird that never returned, it didn't come true in my own life, for on Thanksgiving Day 1981 (October 12), it touched down with its parents on a slough right in front of me and my brother as we drove down a country road 6.5 km NNW of Luseland (52° 08' 20" N, 109° 25' 45" W). We were out hunting ducks and had just approached the slough from the north where the road curved around it, when we saw the three cranes. Amazed, we pulled up and watched them for a while, the first we had ever seen. As we sat there, a dust cloud appeared on the horizon, indicating a vehicle approaching rapidly. Perplexed, we watched as a truck pulled to a stop on the other side of the slough as if the occupants were preternaturally aware of the cranes. Intrigued, we continued on and as we approached, noticed antennas protruding from the vehicle, and a couple of biologists with the U.S. Fish and Wildlife Service, pre-occupied with observing the cranes, clearly not wishing to be disturbed. We learned later that the young bird was equipped with a radio tag, and that the family had strayed west of their usual migration corridor. The cranes remained until at least October 18, after which the biologists continued tracking them toward their wintering grounds in Texas.[11] Except for a single crane that was seen on Grass Lake in about 1957, these were the first cranes that had been seen in the region since they'd been extirpated. By remarkable coincidence, their wayward route had brought them back home to their ancestral breeding grounds, and to us, the descendants of the man who had slain such a family trio long ago. Call it karma, but had we not been raised in a hunter-naturalist family, we would not have been driving down that country road just as the Golden Bird touched down with its parents, followed by the invisible forces of radio waves bringing the wildlife biologists down the same road.

Around the same time that the family trio touched down in its former breeding ground, an ill-fated measure to establish a southern population of whooping cranes was receiving strong publicity and funding. Beginning in 1975, the program involved removal of 'surplus' eggs from the Wood Buffalo population and substitution into the nests of sandhill cranes in Idaho. The program lasted 13 years, resulting in the removal of 289 eggs, and the production of a single hybrid in the wild. There was only a slim chance the cross-fostering of whooping crane eggs would work, but the effort was rationalized because the eggs were considered surplus and their removal was calculated to have no impact on the wild population. However, in hindsight, had the removed eggs been placed in the captive

breeding program, the total population would now be much larger, and could have greatly facilitated present programs to re-establish southern populations through migration guidance by ultra-light aircraft. This program does not yet include the cranes' former breeding ground on the Canadian prairies, but it should, as has been long recommended.[12–14]

In evaluating nesting habitat of whooping cranes and the potential for their re-introduction to the prairies, Hjertaas concluded that they nested sparsely wherever large, shallow marshes were found, and that the "report of 12 Whooping Cranes nesting at Shallow Lake in one year suggests that the large marshes of the grassland were excellent breeding habitats, at least until the 1930s drought."[6] He suggested that a number of factors would need to be evaluated before selecting re-introduction sites, including habitat quality, isolation, hunting pressure, and drought. He proposed that the Quill Lakes–Last Mountain Lake area might be a good candidate, though there were no suitable adjacent sites for expansion. Although the cranes may have been widespread and sparse in their nesting, clearly the last nesting grounds with ideal habitat were situated in the large alkali marshes of west-central Saskatchewan. This habitat is a function of the glacial geomorphology of the region, with its several glacial valleys emanating from the Neutral Hill moraines of eastern Alberta, the last outlier of which is Heart's Hill, the only visible landmark from Shallow Lake. There were and are numerous alkali marshes in the area, probably most of which contained breeding whooping cranes. Being a long-lived species they may have coped with drought by withdrawing to marginal habitat or northern breeding grounds like many duck species do. The present migration patterns of geese and their major concentration in west-central Saskatchewan between Unity and Kindersley is also a reflection of the glacial features of the region, and primordial habitats and migration corridors of waterbirds. As the whooping crane population continues to grow it will need to re-occupy this traditional nesting ground. As Fred Lahrman concluded long ago, "Saskatchewan people are 'Whooper conscious' and they will back to the limit any program which might give the Whooping Crane a better chance to climb to a higher and safer population level."[12] We are ready for the return of the Golden Bird.

Acknowledgements

In memory of my grandfather, Vern Finley, and his friend, Joe Perry, pioneers. Thanks to my mother, Valerie Finley, curator of the Luseland Historical Museum, for her major role in bringing together our local history, and for documenting the return of the Golden Bird.

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Two young moose at Last Mountain Lake, SK *Lowell Strauss*

NOTES AND LETTERS

BEWARE THE WHISKEY JACK

Whiskey jack (gray jay). *Theron Finley*

It was a bitterly cold morning, and I was tracking moose through the fresh powder snow covering a black spruce muskeg. The sense of loneliness and desolation was profound, making me appreciate that I didn't belong there, in the *maskek* country of the Swampy Cree, consummate hunters of the *moswa* (moose). Dejectedly, I realized I didn't have a hope of stalking a moose in the deep silence that cloaked the snow-muffled forest, and I paused at the edge of a beaver meadow, relieved by its openness. At once, I had the eerie sense that I was not alone, and as I nervously glanced back at my trail, a gray phantom floated gracefully and silently like an owl across the meadow, and landed in a tamarack over my head. It uttered some soft whistles, a welcome respite from the solitude, and studied me with dispassionate eyes, assessing my potential as a hunter and provider, before dismissing me. In turn I studied its behaviour, recalling that it was once called the moose bird because it supposedly led hunters to their prey. Although it provided no clues that I could discern as it flew off, on the far side of the beaver meadow, I found fresh beds of three moose and signs of their hasty retreat.

Perisoreus canadensis was once known by several nicknames, including 'camp robber', 'moose bird', 'meat hawk', and 'whiskey jack', none of which can

Theron Finley, unaware that Wisakedjak has landed on his backpack.

Graham Obee

match for sheer utility and dullness the official name given by the American Ornithologists' Union. 'Gray jay' belies one of the most colourful characters of the boreal forest, with a complex and contradictory personality. Intelligent, deceitful, convivial, reclusive, ruthless, gentle, provident, larcenous... the anthropomorphisms abound in the early conservation literature, designed to connect people with nature. Personifying the Canada jay as a national icon, Percy Taverner, in *Birds of Western Canada*, unleashed an anthropomorphic ode:

"If the other Jays are clownish, one scarcely knows how to characterize the Canada Jay. It has all the family characteristics in an exaggerated form, but seems to lack the keen appreciation of its own humour that the others possess. Its entire lack of self-consciousness or poise is notable, and it does the most impudent things with an air of the most matter of fact innocence. No sooner is the camper's fire lighted than the Whiskey Jack is on hand for any good thing that may come its way. Almost before the echo of the rifle has died on the hills, he is in at the death to share in the offal of the game."[1]

Excusing its camp robbery and fondness for eggs and nestlings of songbirds, Taverner noted that "(f)ew wild things have as many human friends in the woods as this bird."[1] Yet in spite of its friendliness and willingness to take handouts, Taverner thought it peculiar that the whiskey jack never habituated to civilization like other corvids, but shrank away to the most lonely, secluded haunts, while its brilliant blue cousin adapted and prospered. Although its sobriquet conjured images of lumber jacks, Tom Thompson, and Algonquin Park, had Taverner delved further into its etymology he would have discovered a principal character in Cree legends.

Wi-sak-a-chak or *Wisakedjak* derives from the Algonquian language, translated

as the "flatterer"[2] or the "hypocrite",[3] a sort of trickster who disobeys his creator, *Kitche-manitou* or *Ki-sei-men'-to*, bringing his wrath to bear with a great flood like the biblical myth, but richer in detail and perhaps pre-dating it. The great explorer David Thompson recorded a version of it before the missionaries entered the scene. The story was told in many variations by gifted orators around the campfire.[3] Very briefly, Thompson's story goes something like this:

After *Kitche-manitou* had made all the animals and the first people, he said to *Wisakedjak*, "Take good care of my people, and teach them how to live. Show them all the bad roots, all the roots that will hurt them and kill them. Do not let the people or the animals quarrel with each other."

But *Wisakedjak* did not obey, and he let the creatures do whatever they wished. Soon they were quarrelling and fighting and shedding much blood. *Kitche-manitou* warned *Wisakedjak* that if the bloodshed continued, he would unleash a flood to cleanse the earth. But *Wisakedjak* didn't obey, and continued to trick the animals and the people, making them angry with each other. The earth turned red with blood.

Kitche-manitou became angry and fulfilled his promise. It rained and rained. The rivers overflowed, cleansing the land. Only three inhabitants survived with *Wisakedjak*, an otter, a beaver, and a muskrat. It's a long story, more engaging than that of the ark, but in the end, after much cajolery, the meek little muskrat saved their day, and *Kitche-manitou* started all over again, creating the people, the animals, and the trees. And he took away all *Wisakedjak*'s powers, except to deceive and flatter. After that, *Wisakedjak* played tricks upon the people and animals and led them into much mischief, providing endless stories for the amusement of generations.

So if you find yourself standing alone some day in the profound silence of a black spruce and tamarack forest, when it's 30 below, and you suddenly have the sensation you are not alone, beware.

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... everything in nature is lyrical in its ideal essence, tragic in its fate, and comic in its existence.

- George Santayana

BOREAL OWL MONITORING IN THE NISBET FOREST: 2010 YIELDS FIRST BREEDING RECORD

Figure 1. Adult boreal owl in the entrance to a nest box. *Shelly Fisher*

Boreal owls (*Aegolius funereus*) have a continuous breeding population in the boreal forests of Canada and Alaska.[1] They usually use natural cavities in snags and stumps or excavations made by northern flicker (*Colaptes auratus*) or pileated woodpecker (*Dryocopus pileatus*), but will readily use nestboxes (Fig. 1).[2]

Boreal owl breeding records for the province of Saskatchewan are few. One nest containing four young was found on 12 June 1938 in an old pileated woodpecker excavation on the banks of the Leather River east of Armley.[3] There are four nesting records from the Besnard Lake area, all in American kestrel (*Falco sparverius*) nest boxes. On 22 May 1988, a depredated nest box contained one egg and egg shells. The second and third Besnard nestings were within 500 m of each other in 1993. One held four eggs on 24 April and fledged young by 17 June, and the other held three eggs on 28 May and fledged young by 24 July. The fourth Besnard account, also for 1993, was of a breeding attempt as evidenced by a broken egg and eggshells at the base of the nest tree on 24 May.[4]

The Nisbet Provincial Forest (hereafter called Nisbet), north of Prince Albert, SK, is located in the southern half of the province in the Boreal Transition Ecoregion. It is considered an island forest because it is completely surrounded by agricultural and urban development. The Nisbet forest is characterized mainly by northern boreal forest, but approximately 25% of the area is used for agricultural production, most of which consists of grazing leases. It is separated from the Northern Provincial Forest by 30 to 40 km of mixed agricultural land. The Nisbet Forest is approximately 83,000 ha in size and consists of five separate parcels of forest.[5]

During the years 2007, 2008, 2009, and 2010, personnel and volunteers conducted banding operations for northern saw-whet owls (*Aegolius acadicus*) at Nisbet Banding Station on the northern edge of the Nisbet Forest, 11.5 km NE of Prince Albert. Our setup included a series of two to four 12-m mist nets monitored nightly during September and October. Nets were typically set from dusk until midnight when weather conditions were suitable. An audio lure (male northern saw-whet owl song) was used to attract owls to the nets where they were captured for banding. We were surprised to find the occasional boreal owl captured in the nets. We continued our netting operation each season after the saw-whet flight had passed (late October at this latitude), but instead used the boreal owl song as the audio lure and reduced our net array to two or three mist nets for easier maintenance during cold conditions. During the four seasons, we captured and banded 31 boreal owls, although we caught none during the autumn of 2007.

Some of the boreal owls responded to the saw-whet audio lure, but capture rate increased significantly when the boreal owl song was played. During the months of September and October of the four years, we captured only six boreal owls over 160 nights (2515 net-hours) of saw-whet banding operations (1 net hour = one 12-m mist net operated for 1 hour). The remaining 25 birds were captured while playing the boreal owl call over a total of 48 nights (234 net-hours) during late October, November, December, and January of 2008, 2009, and 2010.

We also operate a nest box study for northern saw-whet owls in and around the Nisbet Forest, with a total of 56 boxes in place at present. In view of the strong presence of boreal owls during the autumn and winter months, we speculated that they might also nest in the Nisbet Forest in small numbers and made the decision to include this species in our nest box study. We enlarged the openings of our saw-whet nest boxes from 7.5 cm to 9 cm to accommodate this larger species. When we checked nest boxes on 2 May 2010, we were delighted to find a boreal owl using one of them. We returned to the nest box on 27 May 2010 to band the young and found two healthy boreal owl chicks almost ready to fledge (see front cover). This nest box was located 7 km NW of Prince Albert in a strip of aspens within a stand of primarily jack pine woodland. The nest box was attached to an aspen at a height of 4 m and faced in a southerly direction.

We believe this to be the first record of boreal owls breeding in the Nisbet Forest, and this is certainly one of the most southerly breeding records of this species documented for Saskatchewan.

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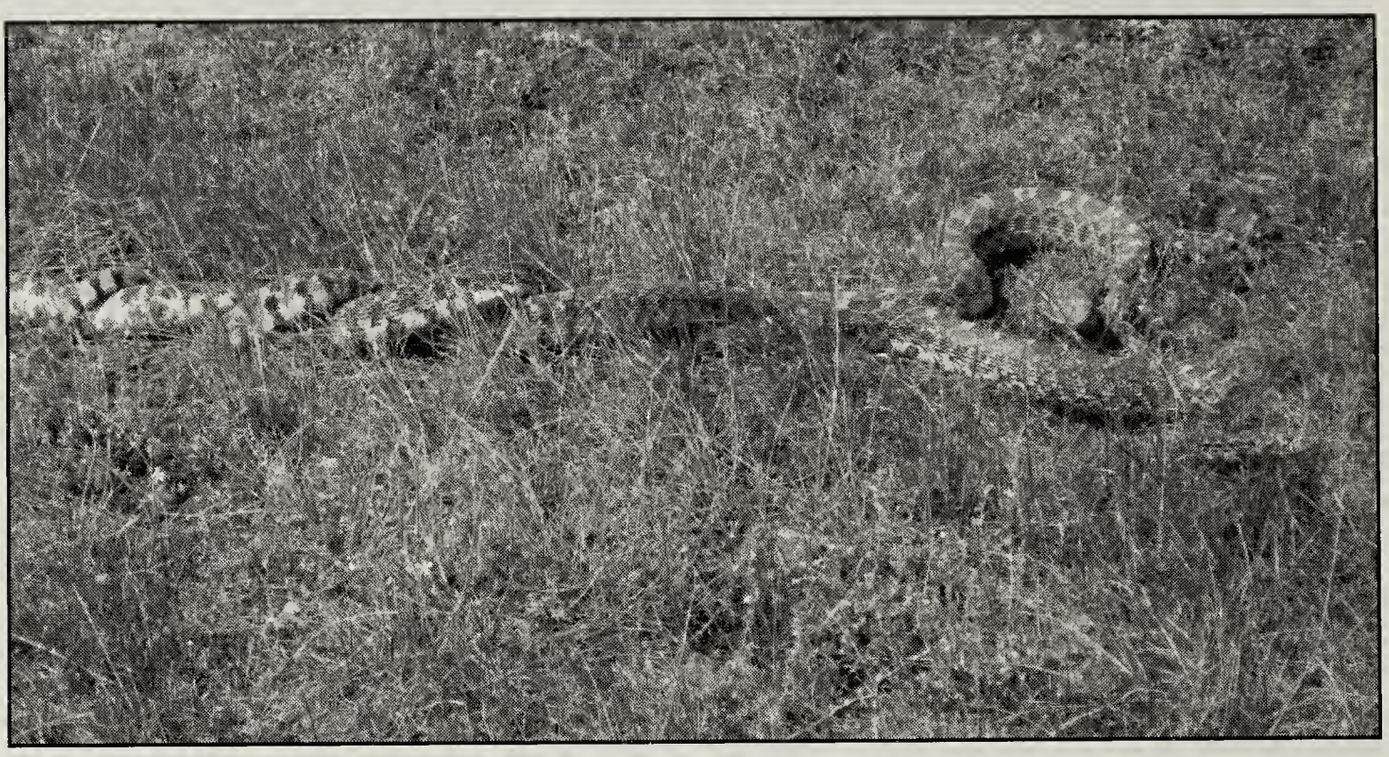
PHOTO NOTES

MATING BULLSNAKES



Mating bullsnakes (*Pituophis catenifer sayi*) are a rare site to encounter in Canada, where this subspecies is at the northern extent of its geographic range in North America. This mating pair was discovered on 15 May 2010 in the Val Marie PFRA pasture northwest of Grasslands National Park, Saskatchewan. Little information is available on the habitat requirements of this snake, a subspecies of the gopher snake, and the size and extent of Canadian populations are completely unknown. Bullsnakes are the largest snakes in western Canada, capable of reaching over 2 m in length. Mammals are the primary prey of this nonvenomous constrictor, which is capable of consuming prey as large as rabbits and hares. Bullsnakes are also accomplished burrowers with a pointed snout adapted for tunnelling in loose soil. A rare adaptation in snakes, which tend to use burrows constructed by other species, this behaviour is presumably important for creating refuge sites and excavating prey.[1]

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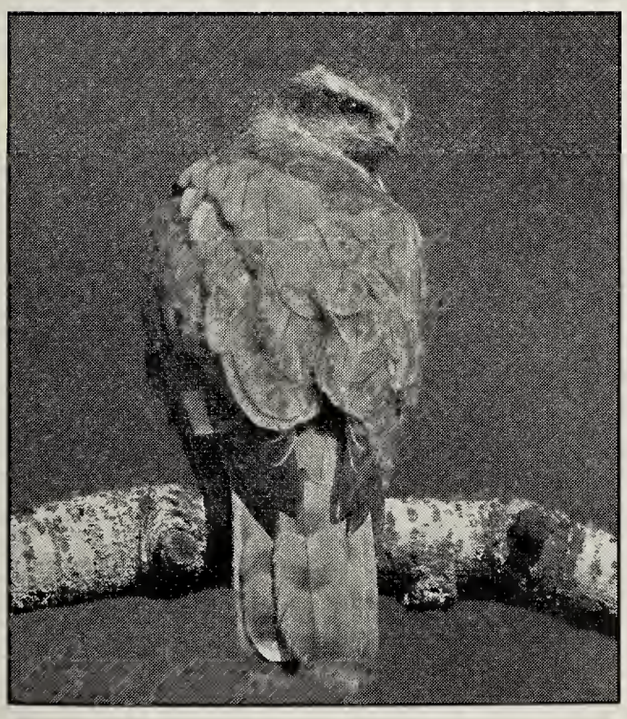
To forget how to dig the earth and to tend the soil is to forget ourselves.
- Mohandas K. Gandhi

GOS

Accipiter gentilis: The Goshawk
Tail-feather fans, barred undertow like blurred
morse code, you float and glide above your dark
wildwood, a soaring wig within a prayer,
mantle as sheer as finest porcelain.
Teased by the light and wind, you're up for it,
perform that rollercoaster sliding dance
in early spring. No psychopath, beak like
a bowie knife, barbed nails' live razor wire,
you kill to live, so famished chicks can thrive.
Born acrobat, only when ravenous,
at fighting weight, can you get close enough
to stand a sporting chance. Blood bolts behind
your yellow-crazed keen eye; you're built for speed,
a stealth attack amongst the startled trees.

- *Peter Branson*



Northern goshawk. *Nick Saunders*

The Laughing Gull

You gambled, let that wanton genie out.
No sweat; the joke's on us. The trouble is,
what it comes down to, see, essentially,
is this: the limbs frail rigging from an old
shipwreck; the body sculpted to bats' wings
and shrouded by black sludge that mauls the beach,
prints shadows in the shifting sand beneath
our feet. Our lust for oil part mollifies
your shame, This gull's not laughing any more,
its corpse set like the skeletal remains
of dinosaur we've chiselled from hard rock,
dead stuff deposited in salt lagoons
before the world we know was shaped and chased,
and we must bear some portion of the blame.

- Peter Branson

I feel no need for any other faith than my faith in the kindness of human beings. I am so absorbed in the wonder of earth and the life upon it that I cannot think of heaven and angels.

- Pearl S. Buck

MYSTERY PHOTO

ANSWER TO THE MARCH 2011 MYSTERY PHOTO

Joanne Marchand had submitted this fantastic photo, and we had posed the clue-containing question, "What the bloody heck is it?"

Reader **Tara Sample** had the answer. She wrote, "Joanne's photo is of the bleeding tooth fungus (*Hydnellum peckii*). There is some really interesting information at http://en.wikipedia.org/wiki/Hydnellum_peckii. Thank you for the photo, it was a fun one to identify!" And thank you to Tara for having the correct answer!

Joanne Marchand provided the following additional information with her submission:

"Here's what I discovered: It is an inedible (but not poisonous, just very bitter) basidiomycete with spores produced on the surface of vertical, 'tooth-like' projections. These are not yet visible on the young fungus in the photo. It is found in North America, Europe, and now Korea and Iran. It forms mycorrhizal associations with conifers. I found it under mature jack pine in Northern Alberta. It is the young fruiting bodies that "bleed" a red pigment that contains atromentin, an anticoagulant similar to heparin. This compound is also said to have antibacterial properties against *Streptococcus pneumoniae*. It is also valued for the dying properties of the pigment, which produces blues and greens with a mordant."

JUNE 2011 MYSTERY PHOTO

In this issue, our Mystery Photo is not about "what?", but rather, "where?" Mark Brigham submitted this photo: in the foreground is a large pile of logs, atop which are perched two tiny birds that Mark assured us are burrowing owls (*Athene cunicularia*). Can you guess where this photo was taken? (For a colour version, see the inside back cover, bottom.)

Short-eared owl. *Pete Hardie*

Rough-legged hawk (Buteo lagopus). *Nick Saunders*

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Common and scientific (Latin) names are used for all species. Common bird names follow the Checklist of North American birds by the American Ornithologists' Union (7th edition, 1998); mammal names: Mammal Species of the World by Wilson & Reeder; butterfly names: The Butterflies of Canada by Layberry et al.;and names of reptiles and amphibians follow Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with comments Regarding Confidence in our Understanding, Sixth Edition, by The Committee on Standard English and Scientific Names (Brian I. Crother, Chair) (2008).

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Double rainbows over Last Mountain Lake, SK. (Does this mean there are two pots of gold ??)
Kerry Hecker

Mystery Photo. See p. 104.
Mark Brigham

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